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OF THE

MASSACHUSETTS ASSOCIATION

OF

BOARDS OF HEALTH.

ISSUED QUARTERLY.

PUBLISHED BY

W. S. FRENCH, WEST NEWTON, MASS.

OFFICERS

OF THE

MASSACHUSETTS ASSOCIATION

OF

BOARDS OF HEALTH.

1890.

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(For Two Years.)

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Journal of the Mass. Assn. of Bds. of Health.

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MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH.

ORGANIZED 1890.

Vol. I. January, 1891. No. 1.

This Association, as a Body, is not responsible for statements or opinions of any of its members.

PRELIMINARY MEETING.

In response to the following circular

Office of the Board of Health,
Worcester, Mass.. Nov. 8, 1889.

To the Board of Health in ———.

Gentlemen: — It has been suggested that a Society could be formed to advantage, comprising the various Boards of Health throughout the state of Massachusetts.

This Society should hold meetings annually, or oftener, in different places, at which a dinner could be served. The objects should be:

1st. To discuss topics, and hear papers of sanitary interest.

2d. To aid legislation and secure uniform interpretation and enforcement of existing statutes.

3d. To compare the rules of local boards and city ordinances, for the purpose of advance in sanitary matters.

4th. To secure co-operation between local boards, for the suppression of disease, especially epidemics, and for the abatement of nuisances.

5th. To establish pleasant and helpful social relations among the Boards of Health through the state.

Will you please send your opinion of this matter as early as convenient, and any suggestions that you may like to offer?

Very truly yours,

L. F. WOODWARD, M.D.,
Chairman of Worcester Board of Health.

thirty-five gentlemen connected with twenty-four Boards of Health in the state, met at Huntington Hall, Institute of Technology Building, Boston, on Saturday, Jan. 11, 1890, at two P.M. Dr. S. H. Durgin, of Boston, was chosen Chairman, and Dr. J. B. Field, of Lowell, Secretary, for the purposes of temporary organization. Dr. L. F.

Woodward, of Worcester, then explained the origin of the proposed organization. The Worcester Board of Health had sent to every city and town in the state of over two thousand population, a circular relative to the formation of an association of Boards of Health. The replies to this circular were so favorable that the Boston Board of Health issued a call for the present meeting.

After a general and informal discussion of the needs, work and benefits of such an organization, the following gentlemen were chosen a committee to draft a Constitution and By-Laws and to nominate a list of officers, with instructions to report within sixty days: L. F. Woodward, M.D., H. P. Walcott, M.D., S. H. Durgin, M.D., J. A. Gage, M.D., W. K. Knowles, M.D., J. B. Field, M.D.

Mr. Babbitt, *of Boston:* — I move that the next meeting be held in Boston as soon as the above committee is ready to report, and that the Boston Board of Health shall have charge of the arrangements for the same, at which a subscription dinner, costing not more than $1.50 per plate, shall be given.

The motion was adopted with applause.

Adjourned, subject to call of Boston Board of Health.

FIRST REGULAR MEETING.

The first regular meeting of the organization was held at the Revere House, Boston, March 19, 1890, and was called to order by the temporary Chairman, Dr. Durgin.

The records of the preliminary meeting were read and approved.

The Committee on Constitution made its report, and submitted a draft of a Constitution, which, after a few amendments suggested by the members present, was adopted.

The Committee on Nominations of Officers for the ensuing year submitted its report, which was accepted, and the following nominees were unanimously elected:

President, Henry P. Walcott, M.D. (Chairman of State Board of Health and member of Cambridge Board of Health.)

First Vice-President, Samuel H. Durgin, M.D. (Chairman of Boston Board of Health.)

Second Vice-President, Samuel W. Abbott, M.D. (Secretary of State Board of Health and member of Wakefield Board of Health.)

Secretary, LEMUEL F. WOODWARD, M.D. (Chairman of Worcester Board of Health.)

Treasurer, JAMES B. FIELD, M.D. (Chairman.)

Executive Committee, the preceding officers *ex-officio:* For two years — J. E. CLARK, M.D., Medford; W. H. CHAPIN, M.D., Springfield; W. K. KNOWLES, M.D., Everett; E. A. SAWYER, M.D., Gardner; W. S. FRENCH, West Newton. For one year — C. H. MORROW, M.D., Gloucester; A. G. GRIFFIN, M.D., Malden; M. R. DONOVAN, M.D., Lynn; G. L. TOBEY, M.D., Lancaster; H. HARLOW, Plymouth.

Dr. Walcott on taking the chair, after thanking the Association for the honor conferred upon him by making him its first President, made a few remarks upon the objects and work of the Association, and the necessity for united, energetic and intelligent action by its members.

THE PRESIDENT stated that he would appoint the Committee on Papers and Publications at the next meeting.

Mr. BABBITT — I move that the Secretary be instructed, in behalf of the Association, to extend its sincere thanks to Gen. Francis A. Walker for the use of Huntington Hall at the preliminary meeting of the Association.

The motion was adopted by a unanimous vote.

Voted, That five hundred copies of the Constitution and By-Laws, with a list of members, be printed.

Adjourned.

At the close of the business meeting about sixty members sat down and enjoyed the elegant dinner prepared by the proprietor of the Revere House. A general social chat and good time wound up an enjoyable meeting.

SECOND REGULAR MEETING.

LOWELL, MASS., June 19, 1890.

The second regular meeting of the Association was holden by invitation of the Lowell Board of Health at Lakeview Park, the summer resort of the citizens of Lowell.

Upon their arrival the members of the Association became the guests of the Lowell Board of Health, and were taken on a carriage ride through the city, visiting among other points of interest Fort Hill Park, Belvidere and "Little Canada." Upon returning from this ride, special electric cars were taken to Lakeview Park. Before dinner a steamboat ride was taken around the lake. About fifty members sat down to dinner, which was served in the upper hall of the pavilion overlooking the lake. After discussing a delightful ménu the President, Dr. Walcott, rapped the meeting to order, and after cigars had been lighted, Dr. Field, Chairman of the local Board, introduced His Honor, Charles D. Palmer, Mayor of Lowell.

The Mayor welcomed the Association to Lowell in a felicitous address, in which he referred to the importance of sanitary work, and the value to a community of a well-organized Board of Health.

The records of the last meeting were read and approved.

Dr. Field then read a paper on "The Disposal of Garbage," which was listened to with great interest.

The discussion upon the paper was opened by Dr. Charles V. Chapin, Superintendent of Health of Providence, who was followed by Dr. J. Arthur Gage of Lowell, and others, which was hurriedly brought to a close by the necessity of reaching the trains.

The President — We will now take up the consideration of applicants for membership.

The Secretary — I have the following list of applicants for membership, who have been passed by the Executive Committee, and are recommended to the Association for election: —

F. W. Draper, M.D., Boston, Mass.

Charles V. Chapin, M.D., Supt. of Health, Providence, R.I.

F. W. Jackson, M.D., Weston, Mass.

L. F. Severance, Brockton, Mass.

David E. Baker, M.D., Newtonville, Mass.

The names as submitted were unanimously elected to membership.

The President — I will appoint as the Committee on Scientific Papers and Publications the following members: —

Samuel H. Durgin, M.D., *ex-officio*, Boston.

David E. Baker, M.D., Newtonville.

Ernest S. Jack, M.D., Melrose.

Voted, To refer the matter of the next meeting to the President and Secretary with full powers.

Voted, To extend the thanks of the Association to the Lowell Board of Health and its Chairman, Dr. Field, for the many courtesies received.

Adjourned.

THIRD REGULAR MEETING.

WORCESTER, MASS., Oct. 15, 1890.

The third regular meeting of the Association was held at Worcester by invitation of the local Board.

The members of the Association met at the office of the Board of Health at 1.30 P.M. Barges were then taken, and a visit made to the city's works for purification of the sewage, the party being in charge of the City Engineer. Chas. A. Allen. After a thorough inspection of the works, the Association were driven back through various parts of the city to the Worcester Polytechnic Institute, where the regular business meeting was held, the visitors first being shown over the building.

In the absence of the President, the first Vice-President, S. H. Durgin, M.D., took the chair.

The records of the last meeting were read and approved.

THE VICE-PRESIDENT — The first business before the meeting will be action on the propositions for membership.

THE SECRETARY — I have the following list of applicants for membership, who have been passed by the Executive Committee, and are recommended to the Association for election: —

Prof. T. M. Drown, Massachusetts Institute of Technology, Boston, Mass.

Prof. W. T. Sedgwick, Massachusetts Institute of Technology, Boston, Mass.

Prof. L. P. Kinnicutt, Worcester Polytechnic Institute, Worcester, Mass.

Charles A. Allen, City Engineer, Worcester, Mass.

Edwin D. Wadsworth, Milton, Mass.

C. L. French, M.D., Clinton, Mass.

T. H. O'Connor, M.D., Clinton, Mass.

T. F. Roche, M.D., " "

P. T. O'Brien, M.D., " "

P. P. Comey, M.D., " "

James Kimball, Agent Board of Health, Springfield, Mass.

By vote of the Association all the foregoing parties were unanimously elected to membership.

Prof. Leonard P. Kinnicutt, of the Worcester Polytechnic Institute, then read a paper on "The Disposal of Sewage, together with an account of the Worcester Sewage Works," which was discussed by Profs. T. M. Drown and W. T. Sedgwick, of the Massachusetts Institute of Technology, Boston, and Mr. Charles A. Allen, City Engineer of Worcester, after which the discussion became general.

A vote of thanks was then passed to Professors Kinnicutt, Drown and Sedgwick and City Engineer Allen, for the interesting and valuable papers and information given; also to the Worcester Board of Health for the courtesies received from them.

Adjourned at 5.30 P.M. for dinner at the Bay State House, which was attended by about fifty members, several being obliged to leave at the close of the business session.

THE DISPOSAL OF GARBAGE.

BY JAMES B. FIELD, M.D., CHAIRMAN OF LOWELL BOARD OF HEALTH.

(Read at the meeting held at Lowell, June 19, 1890.)

The consideration of how to properly dispose of the waste materials of a city has given rise to many problems of sanitary science. Under the head of waste products will come a variety of substances which directly or indirectly engage the interest of the sanitarian.

The human body produces several kinds of organic waste. Thus the disposal of urine and fæces, and of the air rendered impure by respiration, leads to the problems of house drainage and ventilation. The disposal of ashes, house-dirt, and street-sweepings also comes within the province of the health officer. Then, again, there are the waste products of manufactures, some of which vitiate the air by their odors, and others of which pollute the streams of water into which they are discharged. Even the subject of disposal of the dead would come under this head.

The present paper does not treat of the disposal of all varieties of waste material, but only of one kind, not as yet mentioned. I refer to the refuse of food-stuffs as found in the household and in the markets, and known as garbage.

Before entering upon a discussion of the disposal of garbage, we ought briefly to consider the methods of its collection. These may be divided as follows: —

1. Collection by private individuals without license or control.
2. Collection by licensed swill-gatherers.
3. Collection by a contractor.
4. Collection by the municipality.

In the small country village nearly every household disposes of its own swill. Perhaps, however, the doctor, the minister, and the postmaster do not keep pigs, but dispose of their table refuse to their neighbors. This may be the first point in the evolution of the swill-

collector. As the village grows into a town, with manufacturing interests, the need for gatherers of garbage increases. Enterprising farmers, with cattle and pigs to feed, obtain this refuse matter for little or nothing. They gather it wherever they please, whenever they please, and transport it in any kind of a receptacle or conveyance. This is altogether wrong. Swill should be collected at regular and frequent intervals, and in an inoffensive manner. Fortunately, this can be seen to, even in our smallest towns. The power given by the Public Statutes allows Boards of Health to make such regulations as are necessary for the public health, and under this head would certainly come a rule which should place such restrictions upon the collection of garbage as the following:

1. Each collector of swill should be obliged to obtain permission of the Board of Health before pursuing his calling.

2 The receptacles used to convey the refuse should be water-tight and securely covered, so that no odors could escape.

3. The collector should be obliged to furnish a list of places from which he takes swill, and should be required to visit these places at least every second day.

There is no doubt that every town in the state can thus compel its swill-gatherers to be licensed, and to comply with restrictions similar to the foregoing, or even more rigid. To enforce such measures, fortunately, requires no expenditure of money, but simply an expenditure of energy by members of the Board of Health, and a few prosecutions in the police court.

The licensed collector, thus hemmed in by restrictions, inspections, and fear of prosecution, will do the work much better than the man who is allowed to run wild.

Much more preferable than licensed collectors is the man who does the work by contract, for it is much easier to hold one man responsible than it is to look out for several collectors, each infringing on the other's territory.

The ordinary contractor will bear watching. He collects the city's refuse, not because he is a philanthropic sanitarian, but because he is on the make. To keep down expenses means to do the work in a slovenly manner. The garbage contractor, therefore, should be compelled to live up to a carefully-drawn set of rules. The only satisfactory way, however, to have a city's refuse collected, is to have it done by the health department. It will not do to intrust this work to

the street department, the pauper department, or to any other branch of municipal work. It must be under the direction of men who believe the cheapest way to do sanitary work is to do it well. In other words, the ideal way of collecting garbage is to have it done by the employees of the Board of Health.

Far more important than the methods of collecting garbage are the methods of its disposal. We may divide these methods as follows:—

1. Use of garbage as a food for animals.

2. Disposal of garbage upon the land or upon bodies of water.

3. Destruction of its garbage by fire or by extraction of its valuable constituents.

Until recent years the custom was well nigh universal of using swill as a food for cattle and swine. Sanitarians have long recognized the harmfulness of such procedures, but it is only recently that the laity have begun to be aroused on the matter.

The fact that a diet of swill will at times increase the percentage of solids in cow's milk is known not only to the health officer and the chemist, but also to the dairyman. A chemical analysis, however, does not reveal all the qualities of a sample of milk. Whether bacteriological examinations would show that the milk came from swill-fed cows is not known. Two years ago Dr. Abbott, of the State Board, informed the writer that but little had been done in this line of work, and that no definite results had been obtained. Clinical evidence as to the injurious effects of swill milk is very strong. Many farmers assert their ability to distinguish such milk by its odor, and state that fermentative changes occur very rapidly. It is also well known that cows fed on a diet of swill are feverish, restless, and not in a natural state of health. What is of more importance is the fact that the effects of swill milk as an infant diet are extremely injurious. Even if we did not have all this evidence against the use of swill as a food for cows, the mere fact that it is an unnatural food would show that it could not have a favorable effect upon cows or upon the secretion of milk.

Now if a town has to dispose of its swill to outside parties, how can it prevent that abomination of abominations — the use of swill as a food for cows?

Last year, by request of the Lowell Board of Health, a bill was introduced into the Legislature permitting the Board of Health of a city to inspect the premises of all persons whose cow's milk came into the

city, and the premises of all persons who obtained swill from the city. A penalty was provided against the owner of the premises on which swill was found being fed to cows.

Several Boards of Health were present at the hearing before the Committee on Public Health, and the testimony introduced went to show that the effects of swill as a food for cows were similar to those just mentioned. All parties at the hearing were of one mind in wishing that some bill similar to the one proposed, should be passed. The committee, feeling that a bill as strict as the one desired would fail of enactment, substituted the following modification, which became a law May 9, 1889:

[CHAP. 326.]

AN ACT TO PREVENT THE FEEDING OF GARBAGE, REFUSE OR OFFAL TO MILCH COWS.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

Whoever knowingly feeds or has in his possession with intent to feed to any milch cow, any garbage, refuse or offal collected by any city or town, or by any person having authority from any city or town, by contract or otherwise, shall be punished by imprisonment in the jail or house of correction not exceeding sixty days or by fine not exceeding one hundred dollars. [*Approved May 9, 1889.*]

With this law on our Statute Books, the use of swill as a food for cows could be stopped within our state if every town had the will and means to inspect all dairies within its borders, and would prosecute all offenders. Concerted action is what is needed.

Perhaps, however, the Board of Health of some city will say, "What is the use of starting a crusade against swill milk? The surrounding towns are indifferent, and why should we forbid our milkmen to feed swill, when swill milk is brought daily into our city from neighboring towns?"

To such queries we can only reply, that it is far better to partially abate an evil than to make no attempt at all to remedy it.

The Board of Health of a city can, however, obtain the right to inspect dairies in neighboring towns, and thus see that the law is complied with. This right of inspecting dairies in other towns is not given by legislative act, but is acquired in a very simple manner; that is, by refusing to allow any swill to be taken out of the city, without

receiving the privilege of inspecting the farms to which it goes. This method may not be practicable in some communities, but it is certain that the Lowell inspectors are dreaded by the farmers of Dracut, Pelham, Tyngsborough, Chelmsford and Tewksbury.

In some cities the opportunity of feeding swill to cows is reduced to a minimum by the city establishing a piggery to utilize all the city swill. In theory, such a piggery is an intolerable nuisance. The decomposing swill and the presence of large amounts of swine manure, must give rise to an unbearable stench. A practical example of this kind of nuisance and a good warning to all cities contemplating the establishment of a piggery, may be found in one of our Massachusetts cities, in which the pauper department carries the swill to the city farm, where it is fed to nearly six hundred pigs. The process of feeding is carried on partly in an open lot, where the loads of swill are dumped upon the ground. After the pigs have eaten what they desire, the remainder of the garbage is allowed to decompose, thus filling the air with offensive odors. It is but simple justice to the city in question to state that its Board of Health has vigorously fought against the piggery with all its might.

The feeding of swill to hogs is more than a nuisance, for it is dangerous to public health by giving rise to the disease known as trichinosis. This disease in hogs is also propagated to human beings who partake of pork flesh that is not thoroughly cooked. Although epidemics of human trichinosis are much more common in Germany than in this country, yet several cases with a high mortality rate have occurred in our Western states. So far as is known, but few cases are on record in Massachusetts. The interest in the subject of trichinosis has been heightened by the investigations of Dr. Mark, which appeared in the last report of our State Board of Health. He concludes that although hogs may obtain trichinosis from eating trichinous rats, that still by far the greater number of trichinous hogs found in the vicinity of Boston in all probability become trichinous by eating city swill which contained pieces of raw swine-flesh in which trichinæ were imbedded.

Even if there were no danger of trichinosis, yet it is well known that hogs fed upon city swill are not healthy, and that deaths are frequent among them.

Thus step by step do we see that swill is not a suitable food for cows, nor even for hogs. How, then, can we dispose of it?

If garbage is used to fertilize the ground, a large acreage will be required, and it can readily be seen that the process is a nuisance, even if the garbage is plowed into the soil.

To place garbage on a dump is wrong, even if a load of garbage is immediately covered by a load of ashes. A house which has its cellar in a foundation of such material is not fit to live in.

Many communities deposit their refuse matter in some body of water. This method is, however, restricted to towns on the seaboard or on the bank of some swiftly-flowing river. It must be an expensive process to dump all the garbage of a city in the ocean, far away from the channel and from all chances that the refuse matter will be again cast upon the shore.

A town which deposits its garbage in any river or other body of water which is a source of public water supply, by so doing violates the laws of this state. Thus this method of disposing of garbage cannot be availed of.

There is no method which will satisfactorily dispose of garbage without destroying its characteristics. This can be done either by burning the garbage, or else by extracting its valuable constituents.

One solution of the problem of garbage destruction, so far as private families are concerned, is that each family should destroy its own swill. Cook-stoves have been constructed with a receptacle at one side of the fire-box, in which the swill can be subjected to the action of the heat without interfering with the efficiency of the fire. In this way the garbage is gradually dried, and may finally be used as fuel. In the summer, when oil-stoves and gas are largely used for cooking, it would, perhaps, be necessary to saturate the garbage with kerosene before building a temporary fire in the kitchen stove to consume it. Such methods, however, presuppose an amount of intelligence and willingness not found in all our kitchens. This plan must therefore be dismissed as impracticable for universal adoption. Even if this method could be adopted only by the better class of householders, a large saving would be made, not only in the amount of garbage to be destroyed, but also in the expense of collection.

In most cities there is not only house offal, but also the refuse from fruit stores and provision markets. The waste from meats is generally utilized either in soap factories or in fertilizer works. Decayed apples, bananas, oranges, and all other such material should be destroyed in the same manner as swill. There are now very many

cities which wholly destroy their garbage. This admirable plan is in force even in some quite small municipalities. In this particular form of sanitary improvement, which is being adopted throughout the country, western and southern cities have led the van. As has already been stated, there are two methods of destroying garbage. One is by burning the waste material; the other is by extracting grease and other useful products from the garbage. This latter method is known as the Merz system.

In this system of garbage extraction the waste material is received in a large iron cylinder, known as the dryer. In this the garbage is thoroughly stirred and mixed by revolving arms of iron tubing. Surrounding this drying cylinder is a jacket cylinder. Between the two cylinders and also into the two hollow arms of the stirrer is forced superheated steam. The garbage remains in the dryer six or eight hours, subjected by this steam to a temperature of from 250° to 300° F. This heat, acting on the liquid portion of the garbage, forces out a vapor containing all the moisture and noxious gases. By suction-fans this vapor is led into a condenser, from which it emerges as a colorless liquid with a slight odor. Nearly, if not quite, two-thirds of the garbage thus passes off as moisture. The remaining third is removed from the dryer and then conveyed to air-tight vats or extractors, in which it is subjected to the action of benzine and other chemicals for ten or eleven hours. Here the oil or grease is extracted, and is collected in barrels as it flows from the bottom of the extractors.

The residue of the garbage is then drawn from the extractors, conveyed to the drying-room, and finally screened, to remove all bones, glass, rubber, etc. The final product is of a dark brown color and comparatively odorless. It is sold as a fertilizer. The following figures were obtained by our city physician, Dr. Gage, after a careful investigation of the Merz plant at Buffalo. There, from ten to thirty tons of swill are disposed of daily. The steam and power is furnished by a sixty horse-power engine, at a cost of about \$5 per day. Four men are employed, at wages ranging from \$1.50 to \$4 daily. There are also three boys to pick out the rags, etc., and the value of the material thus picked out will pay the boys' wages. One hundred per cent of swill yields thirty-three and one-third per cent of product; about thirty per cent is in the form of a fertilizer rich in ammonia (four and one-half per cent), and sala-

ble at $9 per ton. Three per cent is fat, and is salable at current prices to soap manufacturers. There is a probable profit of about ten per cent on the investment, aside from the expense of collecting the garbage.

One practical objection to the Merz system is the price demanded for it. The company asks a city to pay something toward the erection of a plant, requires the city to collect the garbage, and also to pay for its extraction. The yearly amount paid by the city is said to pay for the operating expenses and interest on the investment. The amount derived from the sale of soap-grease and fertilizer is all profit, none of which, however, accrues to the benefit of the city. To be free from offence a plant of this character should be well constructed and intelligently operated. Some cities employing the Merz process have from various reasons abandoned it. It is certainly an expensive method for the smaller cities.

Nevertheless, there is something that appeals to all of us in the idea of extracting the valuable constituents from garbage. There is in Providence a method somewhat similar to the Merz process, but less expensive. In it naphtha is used instead of benzine, and of its practical workings the superintendent of health of that city will shortly inform us.

To destroy garbage by cremation in a furnace is a comparatively simple matter. If in addition to burning the material we try to avoid offensive odors, it is by no means a simple problem. If a garbage furnace is to be erected near dwelling-houses, it must not be a nuisance.

To fulfill these requirements a furnace should be of sufficient capacity to receive the garbage as fast as it is brought. There should be no adjacent piles of swill accumulating, and perfuming the air while awaiting cremation. To dump the refuse material into the furnace the garbage wagons should be driven into a shed which can be tightly closed while the dumping is going on. With the furnace should be connected a boiler for steam or hot water with which to thoroughly cleanse the carts after they are emptied. In addition, a garbage furnace should be thoroughly constructed, capable of standing intense heat, and be perfectly tight, to prevent the escape of noxious vapors.

A furnace supplied with all these precautions will be a marked nuisance unless some method is devised for destroying the products

of combustion which pour out of the chimney. It is essential that the foul-smelling gases formed by burning the garbage should be themselves consumed. This is done by the use of a secondary fire, over which pass the gases formed by the burning garbage.

This feature of the double fires is an essential part of the Engle Garbage Cremator. In this furnace the garbage is dumped in from above and received on a grating, at both ends of which there is a fire. Below the grating is an evaporating pan to catch the liquid drippings. By an ingenious system of dampers the flame can be made to pass above or below the garbage, and in either direction. After the combustion is once well under way, the resultant gases give forth an intense heat which is of itself a great aid to further combustion. That the second fire thoroughly destroys the odor the members of the Lowell Board of Health can testify from personal observation. There are about twenty-five Engle furnaces already in operation, from New York on the north to Panama on the south. Not only are these furnaces suitable for burning garbage, but they can be utilized for destroying infected clothing, bedding, etc., or even for burning night-soil. The Engle furnace which is the property of the New York Board of Health, is used solely for infected material. The cremators of this pattern used in our southern cities generally destroy night-soil in addition to garbage.

An Engle crematory of suitable capacity for this city could be erected for about $6,000. To run it would require one to one and a half tons of coal a day, and the services of two men. There would be no increase of expense for labor. It would mean for us simply a transferral of men no longer needed at the swill-house and dump. The cost of fuel would be reduced by the sale of ashes, which are rich in materials of a fertilizing value.

Perhaps further investigation will show that the extraction of the valuable products of garbage will be the more advantageous way, but it is certain with present knowledge that cremation is far preferable for cities the size of Lowell. Cremation is cheaper in the first cost of plant, more economical in running expenses, destroys infected clothing, bedding and furniture, and consumes garbage that is mixed with ashes. Extraction of the grease requires an expensive plant, a larger number of employees, treats nothing but garbage free from ashes and other impurities. The profit from the sale of soap-grease and fertilizer does not come to the city. The process, if successful at

all, will be so only in our larger cities. Whatever method is adopted, the plant ought to be owned and operated by the city.

To recapitulate, there is only one suitable method by which to dispose of all the garbage of a city. All refuse and waste of food materials should be gathered from the household and markets at frequent intervals. It should be removed in receptacles as nearly air-tight as possible, and conveyed to some locality on the outskirts of the city. Here the swill and other garbage should either be treated so as to extract their valuable constituents, or what is preferable, they should be consumed by fire. The method chosen should be that which gives the least offence to the neighborhood, regardless of the expense it entails. The whole process, from the collection of the garbage to its destruction, should be performed solely by the health department of the city.

Now that the ideal method of garbage disposal has been sketched, perhaps some of you may wonder how far the Lowell Board of Health practises what its chairman preaches.

Because Lowell has, as yet, been unable to adopt the best methods of garbage disposal, it does not propose, therefore, to adopt no method at all. If we cannot have the ideal method, we propose to come as near it as possible. Thus, if we cannot collect all of the garbage, we collect the greater part of it, and require the remainder to be removed in an inoffensive manner. If we cannot cremate our garbage, we can at least prevent its use as a food for cows.

In Lowell all swill from private houses is collected three times a week by the health department, and is conveyed to a swill-house on the outskirts of the city, where it is purchased by farmers at twenty-five cents a barrel. There is seldom any swill left over at night. If any remains, it is conveyed to a farm and buried. Every night the swill-house is thoroughly cleansed, and is kept sweet and clean. Owing to an insufficient force of men and teams the swill from hotels, restaurants and the large mill boarding-houses cannot be collected by the city. It is removed by licensed collectors. To obtain a license, an application, accompanied by five dollars, is made to the Board of Health. On each application is a list of places at which the applicant intends to collect swill. These places are visited by an inspector, to be sure that they are not private houses. The license is revokable at the pleasure of the Board of Health. Among the con-

ditions of the license are the following: that the licensee shall not permit any swill collected by him to be fed to cows, and that he shall permit his premises to be inspected by the Board of Health at all times. The license is never delivered to the applicant until he has brought to the superintendent for approval his swill-wagon, containing a suitable water-tight covered box or barrels. With these precautions, the swill is collected from our hotels and restaurants in a manner almost as unobjectionable as that in which the health department collects it from private residences. The farmers who purchase swill at the swill-depot have to subscribe to the same conditions as do the licensed collectors.

The methods of collecting the swill of Lowell are quite satisfactory, but those of its disposal cannot merit praise. As we have no method of destroying our garbage, it is used as a food for animals, and all the Board of Health can do is to see that the food is reasonably fresh and is not fed to the one animal so necessary to human welfare — the milch cow.

When the present Board of Health of Lowell entered upon its duties a few years ago, there was no penalty against feeding swill to cows, and a farmer could use this kind of diet for his cows, provided the milk was found, as was often the case, above standard. All that could be done was to control the ultimate disposal of our swill by selling it only to farmers who would agree not to feed it to cows and who would permit the Board of Health to inspect their premises. Of course some few men violated this agreement, but were sooner or later found out by our inspectors and thereafter were not allowed to obtain swill in Lowell. As a result of these inspections several farmers had to go out of business, and sold their cows at a loss. Others found such a profit in this disgraceful occupation that they went long distances to other cities for the swill they could not obtain in Lowell.

We have thus restricted the use of swill, but still more remains to be done. We cannot dispose of the refuse from markets. Unfortunately, it is smuggled on to the dumps after dark. We cannot, with all our care, prevent the swill-house from attracting flies and producing some slight odors. Lastly, we cannot prevent the use of swill as a food for pigs.

In order to do away with swill-house garbage on dumps, and feed-

ing to swine, we have twice recommended cremation of garbage to the city government. We hope soon to make a third request, and trust that it may be granted.

Dr. Charles V. Chapin, Superintendent of Health, Providence, R.I.

I wish to express my satisfaction at this time with the thoroughness with which the subject has been treated by Dr. Field, and I heartily endorse his views, that different towns require different methods for the disposal of garbage. In regard to my own city, Providence, the feeding of garbage to swine and cattle had been in vogue for many years, and I was heartily disgusted with it. The pork from the swill-fed hogs was flatly refused by all local butchers.

Within a few months a new process of garbage disposal has been adopted. It consists not in the destruction of the garbage, but in the utilization of all its valuable ingredients. The process is as follows: The garbage, as soon as discharged from the collecting-wagons, is put at once into the "extractors." These are large wrought-iron tanks, six feet in diameter and eighteen feet long. After they are filled the cover is screwed down, and is not again removed till the process is completed. By means of an arrangement of pipes within the extractor, by which applications of naphtha and steam are made to the garbage, the material is completely dried and the grease extracted at the same time. The details of this operation are its essential features, and the process is a secret one. All the foul odors of the garbage are condensed into a small volume of water, which is, after all, not very offensive, and could readily be discharged into a sewer or small water-course. The only odors which can be a nuisance are those arising from the unloading of the garbage-wagons for the treatment of the garbage itself, which is conducted in perfectly air-tight tanks and pipes.

The grease obtained can be used for any purpose for which dark, cheap grease is applicable. The solid residue, called tankage, is valuable as a fertilizer to mix with phosphate rock.

I am satisfied that both this process and cremation could be conducted without any great nuisance, but neither should be carried on in thickly settled business or resident portions of a town. The trouble is in unloading the swill from the wagons and putting it into the "extractors" in the one case, or the furnaces in the other. The

success of either process, so far as freedom from nuisance is concerned, consists in strict attention to details.

As to the pecuniary advantage of the Providence system, it must necessarily depend largely on the local cost of fuel and the value of fertilizers and grease, all of which vary greatly in different places. In most cities, I think the Providence system would prove the best.

SEWAGE AND SEWAGE DISPOSAL,

WITH A DESCRIPTION OF THE SEWAGE WORKS AT WORCESTER, MASS.

BY PROF. LEONARD P. KINNICUTT, OF THE WORCESTER POLYTECHNIC INSTITUTE.

(Read at the meeting held at Worcester, Oct. 15, 1890.)

When six weeks ago your Secretary did me the honor of inviting me to read a paper before you on the treatment of sewage, I accepted with many misgivings.

The subject is so large, and so many things might be said, that I felt I had not the time at my disposal to make a properly condensed paper, and the paper which I have the pleasure of reading to you this afternoon, has, I am afraid, many faults of omission and commission.

I have tried, however, to make it merely an outline of the various methods used for the purification and clarification of sewage.

Sewage, says Professor Drown, is the water supply of a city as it passes off. A more complete definition is that given by Dr. Tidy, that sewage is the refuse of communities, their habitations, streets and factories. A large proportion of the most offensive matter in sewage is human excrement and urine, but mixed with this, there is water from kitchens, containing animal and vegetable matter, the drainage from stables, and further, the drainage of factories, containing all the waste products that are there produced. Sewage is not, therefore, human excrement diluted with water, but water polluted with a vast variety of matters, some held in solution, some in suspension.

Sewage is a very variable substance. It differs in composition in different cities, and in the same city at different times of the year and day; that flowing at night has fewer solids in it than that flowing by day. The sewage of a manufacturing city is of a very different character from that of a residential town, and its constituents in a manufacturing city like Lowell, which is chiefly engaged in one branch of industry, are very different from those in a city like

Worcester, where the industries are varied. We can not, therefore, speak of normal sewage, or say how much organic matter sewage will on the average contain; roughly speaking, however, sewage of cities or towns contains over sixty grains of solid matter in one United States gallon, a little less than half of which is organic matter. More than one-third of this solid matter is dissolved in the water, the remainder being suspended. Sewage also contains as a rule more than five grains of combined chlorine in a gallon. But each town and city turns out a special type of sewage, whose nature, effect, and proper mode of treatment can only be determined by careful examination and experiment. A method of treatment that might be successful in one place might fail in another.

All sewage, however, contains organic matter rich in nitrogen, and has one common property, that of decomposition. Fresh sewage has very little odor, and gives no more offense than fresh kitchen refuse, but within forty-eight hours decomposition begins, and not only are odors of a most offensive nature given off, but substances are formed which serve as nutriment for those low forms of animal and vegetable life which are considered especially dangerous to human beings. The proper removal and disposal of the refuse of a city is, therefore, a question of the first importance.

This was recognized in very early times, and the sewage works of Rome nearly equalled in magnitude those of its water supply. The most notable example of these ancient sewers is the Cloaca Maxima, built about 600 B.C., which has defied the vicissitudes of more than twenty-four hundred years, and is still used for the purpose for which it was built.

During the wars and political disturbances that followed the fall of the Roman Empire, sanitary science was neglected and allowed to pass into decay, and it was not until the beginning of the present century that the removal of sewage from cities received any serious consideration.

The first method used for the disposal and purification of sewage was, undoubtedly, what may be called the water carrier and purification system. This may be defined as carrying the refuse of towns and cities through drains to a stream, river, arm of the sea, or to the ocean. The theory of the process is, that if sewage is greatly diluted with water the oxygen dissolved in the water will indirectly burn and destroy the organic matter. This method is still the common one

everywhere except in England, and its merits and demerits can be ascertained by seeing how it has worked in a large number of cases, under varied conditions.

From investigations that have been made it seems that when the volume of an untidal river is much greater, say thirty to forty times the volume of the sewage, and when the current of the river is over one mile per hour, for a distance of four or five miles from the point where the sewage enters the river, sewage can thus be disposed of without causing any offense.

These conditions, unfortunately, do not occur as often as might at first be supposed. A stream may usually have sufficient water to dilute a sewage discharge, but during the hot summer months it may be found to be insufficient. The current of the river may average over one mile per hour, but have places where there is slack water in which the decomposable matter settles.

As illustrations of this method of disposal, I will cite the following examples: Boston sewage was formerly discharged on its shores at the head of docks; the dilution was very much greater than thirty fold, but there was seldom any current, and solid particles settled in masses, giving off most offensive odors. Now, the sewage of the city is all discharged into a good current in the harbor, and only a very slight nuisance is produced. Providence discharges its refuse into the bay where there is no current, and so much of a nuisance follows that they have decided to purify the sewage by chemical precipitation. Worcester sewage ran into the Blackstone, a stream whose volume is on the average only five times greater than the volume of the sewage, and I do not think it is necessary to dwell on the condition of that stream. The bulk of the sewage of Lawrence is discharged into the Merrimac river where there is plenty of water and a good current, and no trouble has ever been experienced. Sewage discharged into the Mississippi is rapidly oxidized and carried off. The Amazon river might possibly take care of the sewage of the world.

When sewage can properly be emptied into water, this method is generally found to be the best and cheapest. Unfortunately, as we have seen, it can not often be used with safety, and other means must be employed. The small area, great density of population and multiplicity of manufactories in England, combined to produce in that country the most extensive pollution of natural waters, and it

was consequently there that public opinion first demanded a solution of the problem of sewage purification, and the various methods which I shall mention, originated there.

THE MIDDEN SYSTEM.

Under the name of the Midden system I include the methods which have been devised to collect human excrement, including urine, separately from the other refuse of a community.

The amount of fœcal matter voided by each person daily, averages a quarter of a pound, twenty-five per cent of which is solid matter. One thousand persons would therefore yield sixty-two and one-half pounds of dry fœcal matter per day. The daily amount of urine per person is in the neighborhood of three pints, containing two and one-half ounces of dry solid matter; for one thousand persons this equals one hundred and fifty pounds per day.

A community containing one thousand persons would void in a year, 77,462 lbs. or 34.6 tons of dry solid matter, of which 58,315 lbs. or 26 tons is organic matter, which undergoes decomposition.

The first method used to prevent this large amount of organic matter from causing a nuisance was to collect it in cesspools. There are so many and such great objections to the cesspool that its use has been prohibited in almost all cities. Among these objections may be mentioned, the obnoxious and dangerous odors given off, the danger of polluting neighboring wells, and the difficulty of removing the contents, as must be done from time to time.

An improvement on the cesspool system is the pail, or what may be called the temporary cesspool system. A simple tub or pail is placed under the seat of the privy, to collect all the excretal matters. These pails are collected every day by contractors and their contents used for manure. This system has been, and is now, used in many large cities to a greater or less extent, as for example Edinburgh, Glasgow, Paris and other continental towns. There is no doubt that this system is more healthy than that of having large cesspools in the vicinity of human habitations.

It necessitates only a pail with or without disinfectants, and a system of carefully regulated collection. The advantage of the plan is that the collection must be carefully looked after, for if the refuse is allowed to remain too long, it immediately makes itself known by offensive odors. I do not think the pail system should ever be intro-

duced into cities; but for small towns unprovided with sewers, much may be said in its favor.

The Liernur or Pneumatic system is an outgrowth of the pail system. In this, the human excrement and urine are removed from their receptacles and drawn through air-tight iron pipes to a central reservoir, by means of a vacuum, caused by an air-pump, the contents of the reservoir being emptied each day into hermetically closed tanks and carried into the neighboring country to be used as manure.

Two varieties of closets are used in the Liernur system. That for the better classes is flushed by a mechanical device, with a very small amount of water, the quantity being limited to prevent dilution of the fœcal matter; that for the lower classes has no movable mechanism, and is used without water. The hopper is so arranged that the fæces fall directly into a trap without touching the sides. The trap always remains full and overflows by gravity into the soil-pipe, while the odors arising from the trap are made to pass through a ventilating pipe into the outer air.

The Liernur system is only for the removal of human excrement, and not for the removal of other refuse matter, such as sink drainage and street washings. In Holland, where a general system of sewage like that employed in the large cities of this country can not be introduced except at an enormous cost, on account of the lowness and flatness of the country, the system may possibly be worked to advantage, obviating the trouble and dirt involved in the pail system.

The dry-earth system is another plan that has been adopted for the separation of human excrement from sewage.

The disinfecting power of earth has been known from very early times, but this knowledge took no practical form in Europe as a health measure until 1858. In that year the Rev. Henry Moule, the vicar of Fordington, believing that much of the ill health in his parish was caused by cesspools, experimented on the deodorizing power of earth and invented the earth-closet.

In its simplest form the earth-closet consists of a pail containing a little earth, placed under the seat of the privy, a box of dry earth being kept in the privy, about one and one-half pounds of which is added to the pail after each visit. There is thus formed a consolidated and inoffensive deposit. When the pail is full it is removed, and after being thoroughly dried by being allowed contact with air, in suitably built sheds, can be used again in the closet. The same earth can be

used certainly three times without giving offense. Its value is even then very small, being only equal to rich garden soil. The best earth to use for this purpose is clay, and sand is the worst. Ashes can be used, but their deodorizing power is much less than that of earth. Charcoal has also been used; its deodorizing power is much greater than earth, and the amount required is only about a quarter as great, but the original cost is much greater. With the earth-closet, disinfectants can be used when considered necessary.

This system would, I believe, work very well in small villages and towns, when well looked after, and it could be easily introduced. In very small villages, each house-owner could easily be taught the proper method of preparing and taking care of the earth. In large villages, the closets could be taken care of by paid scavengers, who would remove the contents and supply fresh earth. If once introduced, it would certainly be a great improvement over the common method of cesspools, which is, as we all know, a constant source of danger.

The advantage of the various forms of the Midden system is, as we have seen, that a large quantity of organic matter, of a kind which is believed to be most injurious to health, is kept out of sewage by excluding human excrement from it.

I know that high authorities state that the sewage of towns in which the Midden system is used is almost identical with that of water-closet towns; but this, I think, rests on very doubtful experiments, and I believe that a much less dangerous sewage would result if human excrement were excluded. Still it would be a very brave man, who would at the present time advise a city to provide itself both with a Midden and a water-carriage system.

WATER–CARRIED SEWAGE.

There are three methods now in use for the purification of water-carried sewage:

Surface or broad irrigation.

Intermittent downward filtration.

Chemical precipitation.

You may notice that I do not mention any form of straining the sewage, as a method of purification. Sewage cannot be purified in this way.

A great number of processes have been tried, using a variety of

substances for the straining material, among which may be mentioned hay, charcoal, ashes, dry earth, sand, and iron slag, and all have been failures. For if the straining material be of too fine a texture it soon clogs, while if it is too coarse, the organic suspended matter is not removed. Any process that depends merely upon straining as a means of purification, is to be condemned.

SURFACE IRRIGATION.

This method was based on the assumption that all the offensive and decomposable substances held in suspension and solution would be absorbed by the soil and taken up by the growing plants, while the effluent sufficiently purified, would pass away into drains, and could be allowed to enter streams and rivers without fear of pollution.

That such a purifying process does take place, may be seen by the simple experiment of pouring a little sewage on a flower-pot filled with earth: the water which oozes out, if not too great a quantity of sewage has been used, will be found to be freed to a great extent of its disagreeable odor.

This system is known under the name of the Sewage Farm system. The sewage is brought to the highest points of the land to be irrigated, conveyed by carriers of a more or less permanent character into some form of sewer channels. These open carriers or surface channels can be mere trenches, and the land more or less flooded by the carriers being dammed up at certain points. The land must of course be so levelled and drained that the sewage will flow over different portions of the ground, and not into hollows, where it would soon become stagnant, or pass away without undergoing the needful purification.

The advocates of this system claimed that the process not only purified the sewage, but that the plants would absorb and assimilate the organic matter of the sewage. Or in other words, here was a process by which the land would be so enriched that the crops obtained from the land would more than pay the expense of purifying the sewage. Enthusiasts full of faith were found to embark in private sewage farms, but it was not long before an unpleasant awakening occurred; it was found that sewage farms were commercially a failure.

The failure can be easily understood, if, as Dr. Tidy well puts it,

we consider that the sewage farmer was compelled, if the sewage was to be purified, to take it at all times, day and night, Sunday and week-days, winter and summer; to take it whether his crops needed it or not; to take it in seed-time and harvest, in wet weather and in dry. Nay, just when the rain is most plentiful, and moisture the least needed, the sewers pour out an increased volume, which must be admitted to the land.

Without going further into details I will only say that it is now universally conceded that no profit can be expected from the cultivation of crops on a sewage farm.

Allowing this, can the system of broad irrigation be used successfully for the purification of sewage? I believe that there is very little question that under favorable conditions, and with certain kinds of sewage, this method of purification is very efficacious. Let us consider for a moment what the favorable conditions are. The first essential is a large plot of land. If, in the experiment with the flower-pot, too much sewage had been added, the water draining out at the bottom would be as impure as the sewage itself. So on a large scale, if too much sewage be added to a plot of land, the sewage will not be purified. Experiments have shown that the smallest amount of land allowable is one acre to one hundred persons, or for a city of the size of Worcester eight hundred acres would be necessary. The land must be at some distance from the city supplying the sewage, and should not border on any populous district, for I do not suppose there was ever any irrigation field which did not in summer give off a loathsome odor. The kind of soil is also a consideration; if it is too open and porous, the sewage passes quickly through it, and emerges scarcely, if at all, purified. If, on the other hand, it is too compact, the water cannot escape, and the soil is rendered swampy. Finally, it must be remembered that all kinds of sewage are not fit to be applied to cultivated land. If there is a large proportion of industrial refuse, such as acids, metallic salts, dye and tan liquors, the sewage will injure or destroy the crops, and may completely sterilize the land.

These difficulties, and the expense of obtaining large areas of efficient land, suitably situated, soon showed that the method was not a practical one for the majority of large cities. The land difficulty must, at least, be overcome, if the system was to be universally employed. The outcome was the development of the intermittent downward filtration.

This system is due to experiments made by Dr. Frankland, of England. It differed from the irrigation system in having the land deeply under-drained, and by applying the sewage intermittently. The soil being drained at a depth of six feet or more, allowed a considerable distance for percolation, and this constituted filtration as opposed to irrigation. The land becomes an indirect oxidizing instrument to burn the impurities, and so transform them into harmless gases, rather than a mere separating or filtering machine.

To obtain the best effects of oxidation, and to keep the land in the most effective condition, the sewage was to be applied intermittently; i.e., with regular intervals of rest, to give time for the air to go into the ground as the water runs out, thus fitting it for a fresh dose of sewage. This constituted the intermittent filtration.

This intermittent action, it was claimed, would avoid clogging the soil and secure its frequent aeration. By such means, it was stated that the sewage of 3,300 persons could be applied to one acre of ground, and perfect purification of the sewage would result. To illustrate the working of the intermittent filtration system, let us imagine a population of 9,900, with three acres of suitable land drained to a depth of six feet. Each acre is sub-divided into four parts, for the purpose of the work; the sewage of 3,300 persons being placed successively on each quarter acre for a period of six hours, eighteen hours being allowed for aeration before it receives another dose. It was allowed that this process involved the sacrifice of the manurial value of the sewage.

This system has received most careful consideration from sanitary men, and it is with this system that extended experiments have been made by the Massachusetts Board of Health at Lawrence. Their report on the subject is now in press, and will appear before many months. Therefore it is not yet time to discuss the method at any length. From what I know concerning the work, however, I believe their experiments will show that domestic sewage — sewage that does not contain refuse from manufactories — can be sufficiently purified to enter a river not used as a water supply, by intermittent downward filtration through carefully prepared beds of sand, and that the sewage of about 1,500 persons can be thus purified on one acre of coarse mortar sand. Their report will also show that the purification does not depend in any way on the removal of organic matter by what we call filtration; that is, mechanical separation, but is due to living

organisms called bacteria, which require free oxygen for their growth. That if the bacteria are not present the purification ceases. The sand filter must therefore be continually supplied with air, and the filtration must be intermittent, so as to allow the air to run in as the water runs out.

The filter beds of sand have now been used for over three years, and their action is as good, if not better, than during the first year; or, in other words, there appears to be no filling up of the air spaces between the sand. With domestic sewage, their experiments have been most successful. These experiments, however, have been made only with domestic sewage, and do not prove anything as to what would take place with sewage containing acid liquors, iron salts, wool waste, and the refuse from tanneries and other manufacturing processes. Could the bacteria live in such sewage and do their work? Would there not be great danger of the spaces between the sand particles becoming filled up, which would not only make the sewage penetrate the ground less readily, but would also retard the entrance of air; and the work of the bacteria depends on their being supplied with oxygen that is in the air.

I have now considered the two systems of purification of sewage by earth treatment, but before I speak of chemical precipitation, I would like to say something as to the hygienic effect of such treatment. The discussion of this question would, however, occupy too much of your time, and I therefore pass directly to the consideration of the next process — chemical precipitation.

Chemical precipitation means the addition of certain chemicals to the sewage, whereby the solid suspended matter and part of the matter in solution is precipitated, and a more or less general deodorization of the offensive constituents, — both those precipitated and those remaining in solution, — is brought about. In this process the sewage from which the grosser matters have been removed is treated with certain chemicals, either suspended in water, or, if soluble, dissolved in water. After such treatment the sewage is run into subsidence tanks, where it is either allowed perfect rest for a few hours, or is passed slowly through a series of tanks. In both cases the precipitation takes place, and the clear liquid, or the effluent, as it is called, is then either allowed to run directly into a water-course, or over a small area of land. The precipitate, known under the name of sludge, is removed from the tanks, and is treated and disposed of in various ways.

The processes for the chemical treatment of sewage are so numerous — I believe that about four hundred and fifty patents have already been obtained — that even a casual mention of each is clearly impossible in the time I have at my disposal, and as the processes differ from each other mainly in the kind of chemicals used, I will restrict myself to mentioning two of the best-known processes, and then point out certain details of treatment essential for the success of any precipitation process.

When lime is added to raw sewage, if the sewage is acid, which is often the case in manufacturing towns, the lime neutralizes the acid, and then carbonate of lime is formed. This salt is insoluble and is heavy, and if the opportunity is offered, the light, flocculent suspended matter in the sewage will be carried down with the precipitated carbonate. In addition to this a certain amount of dissolved organic matter is also precipitated, the lime forming with the organic matter a compound of varying chemical composition.

Salts of aluminium, as alum, have what is called a great affinity for organic matter, and it is on this account that these salts are used as mordants in dyeing. When they are applied to cloth fabrics, they unite with the coloring matter of the dye, which is in solution, and form insoluble compounds on the cloth. This property holds good for the organic matter in the sewage, as it does for ordinary colors used by the dyer or printer. If a solution of crude alum is thrown into a slightly alkaline sewage it is decomposed, a basic sulphate of aluminium is formed which combines with the greater part of the organic impurities, forming insoluble compounds which are precipitated. Aluminium salts, it is believed, have not only the property of precipitating dead organic matter, but also that of removing to a great extent the germs of disease.

The combination of these two salts, lime and alum, was first suggested by Anderson, of Coventry, England, and the process in which they are used is known as the Coventry process. In my opinion this is the best and simplest of all the precipitation processes. It is the one which is used in Worcester, and I shall refer to it again when I speak of Worcester sewage.

The second process is the A. B. C., which consists in adding charcoal mixed with clay and a little blood or other glutinous substance capable of coagulation, and then sulphate of aluminium. No lime is added unless the sewage is decidedly acid. The addition of the char-

coal and clay, it is claimed, arrests all offensive odors, no matter how foul they may be, and the aluminium sulphate acts in the way I have already mentioned.

This process is more expensive than the Coventry, and for the treatment of manufacturing sewage I do not believe it is as successful.

In all precipitation processes, as I have already said, certain details of treatment are essential. The most important of these are the following: —

It is necessary that sewage should be treated when fresh. By fresh sewage is meant that in which active fermentation has not taken place. Speaking generally, the sewage should not be more than forty-eight hours old for effective precipitation, and undoubtedly better results could be obtained with a smaller amount of chemicals when the sewage is only twenty-four hours old.

It is essential that a sufficient amount of chemicals should be used to effect complete precipitation. No greater mistake can be made than to try to save expense on the chemicals, and because this has often been done, the failure of the precipitation process has followed.

One most important essential for the success of the process is sufficient tank accommodation. This is necessary for two reasons: First, that the precipitate may subside perfectly, leaving a clear effluent. If the tanks are too small the sewage will be forced too quickly through them, and this would mean imperfect subsidence of the precipitate. Second, sufficient tank room is necessary, so that the precipitate or sludge may be frequently removed, otherwise the freshly precipitated sewage may be contaminated by the decomposing materials of a previous precipitation. Many a good effluent has been spoiled by foul materials being allowed to remain in the tanks. These materials undergo decomposition, and the gases given off contaminate the effluent.

Using these precautions, what kind of an effluent can be obtained?

My own opinion is that it depends greatly on the character of the sewage treated. If the sewage contains large amounts of metallic salts, with more or less free acid — sewage, for instance, like that of Worcester or any other large manufacturing town — I believe that by using the Coventry process, a clear, odorless effluent can be obtained; that the effluent will contain no suspended matter, and less soluble organic matter than the sewage, and that the organic matter it does contain in solution will, when allowed to flow into a stream whose

volume is from five to ten times greater than the effluent, or allowed to flow on a very small area of sand, be quickly oxidized and destroyed without causing any nuisance.

But before we can decide on the success of the process we must remember that we have the sludge containing the organic decomposable matter of the sewage, still left on our hands. Can the sludge be disposed of so that it will not become a nuisance?

The sludge, as it can be obtained from the tanks, is a slimy mass containing more than ninety per cent of water. It has no commercial value, and I believe the only proper method of treatment at the present time is by fire. This is not so difficult as might be supposed. The sludge can be taken from the tanks to a filter press, where the amount of water can easily be reduced to fifty per cent. and the slimy mass be changed to a solid cake, without odor, and easily handled. Furnaces have been constructed for burning these cakes, and the amount of fuel necessary for the complete destruction of the organic matter is very small. A furnace similar to the one which all cities should own for the destruction of city garbage can be employed, or one and the same furnace can be used for both purposes.

We have seen that a clear effluent can be obtained, and that the sludge can be disposed of without any nuisance being caused; then it may be asked why chemical precipitation has sometimes been a failure. I believe this not to be the fault of the system, but the fault of the way the process has been worked. We have here a process which needs constant, intelligent oversight, just as much as a process of chemical manufacture, and instead of being a process of manufacture it is one of destruction, where in place of money being gained by the improvement of the article manufactured, there is a gain by lowering the standard of the work done. Consequently there is a constant temptation to do poor work, to save chemicals, to neglect looking after the tanks, which, when yielded to, results as all such work must, in making the process a failure instead of a success.

Until a year ago the three processes which I have mentioned were the only ones which had received any attention from sanitary engineers. Last summer a new process was brought to their attention by Dr. William Webster, of England, and though it has not as yet been tried on any very large scale, still on account of its novelty and theoretical correctness, it deserves mention. This process is known as electrical decomposition of sewage. It depends on the fact that

the water and salts, like chlorides and sulphates, which occur in the sewage of all manufacturing towns, are decomposed by a current of electricity. The oxygen, chlorine and sulphur trioxide, which are formed by this decomposition, are given off at the positive pole, and being just liberated from their combinations, are in their most active state, and rapidly oxidize and burn up the organic matter which is in the sewage, odorless and harmless gases being formed. The beauty of the process will be recognized if we remember that the three strongest reagents that the chemist can use in his laboratory for destroying organic matter, are just the three that are here produced in the sewage itself; that we are not obliged to add any chemicals to the sewage, and that the amount of sludge is reduced to a minimum.

The process has, however, not been carefully enough investigated to allow an opinion to be formed as to its practicability on a large scale.

This completes my classification of the methods used for the disposal of sewage, and I venture to submit my own conclusions regarding the various methods; but not wishing you to think for a moment that my opinion is the settled opinion of sanitary engineers,— for the purification of sewage is still in an experimental state, and experts disagree widely as to the value of the various processes.

THE WATER PURIFICATION SYSTEM. For cities situated on the sea or on large and rapid rivers, this method affords the most economical and efficient means of dealing with their sewage.

CESSPOOL SYSTEM. Cesspools should not be allowed in any city, town or village.

PAIL SYSTEM. The pail system affords an efficient means for the disposal of the worst organic substances, in villages or towns which have no sewage system.

THE LIERNUR SYSTEM. This system can not be recommended for any New England city.

THE EARTH-CLOSET. This I consider preferable to the pail system, and should strongly advocate its use in small villages and towns.

BROAD IRRIGATION. — SEWAGE FARMING. This method for the purification of sewage can not be recommended for the great majority of cities. I admit that in certain places it may be successful, as in Berlin, where there is a large sandy area of twenty-six square miles, not more than twelve miles from the city; but I believe that purification of sewage by the sewage-farm system as carried out in England, should not be introduced into this country.

Intermittent Downward Filtration. The system as first proposed by Dr. Frankland, can not be recommended, but it seems probable that, using carefully prepared filter beds, this system may be considered in the future as the best method of treating the sewage of towns and cities whose sewage is of a residential rather than of a manufacturing character. For sewage which contains large quantities of manufacturing refuse, it certainly can not be recommended at the present time.

Chemical Precipitation. This method is, at the present time, the most satisfactory known way for the disposal of sewage containing large amounts of acid, mineral salts, and refuse from factories. A sufficiently pure effluent can be obtained to run into a stream not used as a water supply, or to be run over a very small area of land. The sludge obtained can be pressed and burnt without causing offense.

Electrical Decomposition. At the present time no opinion can be formed in regard to its practicability.

In conclusion, I wish to say a few words about Worcester sewage. When Worcester was at last compelled to take the sewage question into serious consideration, Mr. Allen, our most efficient City Engineer, was requested to study the question and make a report. He made a careful examination of the various methods, visiting England and the Continent for this purpose, and after consultation with experts both in this country and in Europe, reported, as I think, correctly, that the best system for Worcester was the chemical precipitation process.

As regards the plans and the work done, full details may be of interest. All the sewers of the city enter Mill Brook, which empties into the Blackstone at Quinsigamond village. The minimum flow of Mill Brook is about 2,000,000 gallons, and its maximum flow at least 50,000,000 per day, while the normal flow of Worcester sewage is between three and four million gallons per day. For any system of sewage purification, therefore, some means will have to be devised to carry the sewage to the purification works without allowing it to mix with the water of Mill Brook. After a careful study of the problem, Mr. Allen has recommended the building of a separate conduit for the waters of Mill Brook, and working plans are now being made.

At the present time three or four million gallons of the sewage and water of Mill Brook are diverted from their course by a gate-way at

Quinsigamond village, and carried to the precipitation works. In this way, in the hot summer months, when the brook is in its most offensive state, over two-thirds of its total flow is subjected to chemical treatment, while in wet weather, when the brook is in a much better state, only one-tenth of the flow is taken to the works.

The works consist of a boiler and engine house, a mixing-room for the chemicals, precipitation tanks, sludge well, etc., so arranged that their capacity can be easily doubled.

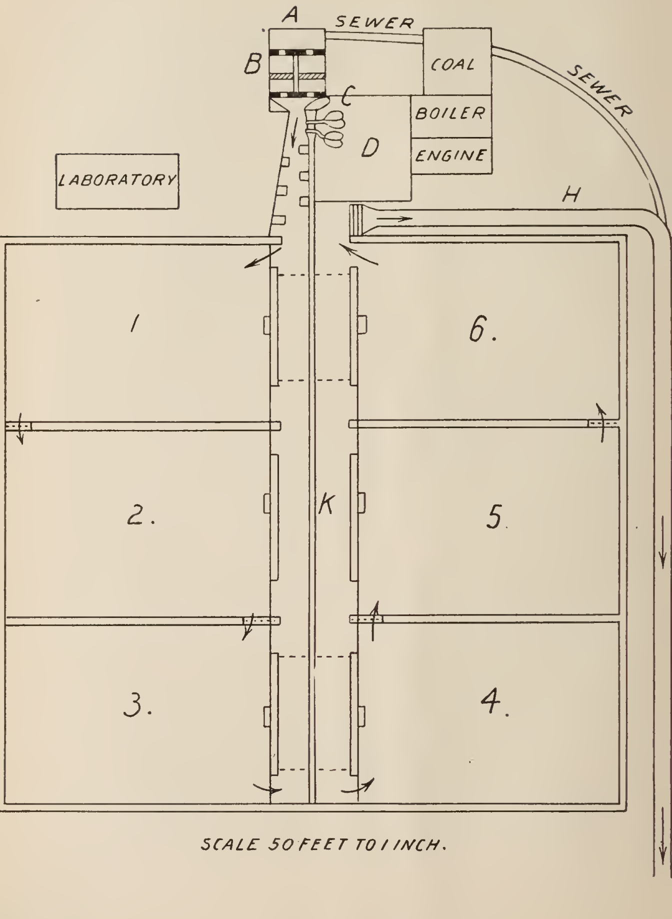
Reference to the drawings I have placed before you may make the arrangement more easily understood.

The sewage is brought by the outfall sewer A to the gate-house B, which is divided into two parts, each part containing an iron screen. The gross matters in the sewage are thus removed, and by means of gates the sewage can be carried through either part, allowing a continuous flow while the screens are being cleaned. From the gate-house the sewage runs through the channel C to the tanks. From this channel, by means of a small pipe, a little of the sewage is carried into the mixing-room D, where there are four mixing tanks, two for the lime and two for the alum. The mixing and dissolving of the chemicals is aided by mechanical stirrers run by steam, and the lime and alum, which after this treatment are partly in suspension, partly in solution, are carried back by pipes into the channel C. This channel is furnished with baffle plates made of wood, and the fall being about one foot, the chemicals become thoroughly mixed with the sewage.

The sewage then enters the precipitating tanks; these are six in number, made of brick, with concrete floors one foot in thickness. They are each 66 feet long, 100 feet wide, and 6 feet in depth, — the total capacity being 1,500,000 gallons. They are so arranged that they can be used intermittently or continuously, and for the purpose of removing the sludge and cleaning the tanks, any one can be shut off from all the others.

The sewage enters the tank marked 1, and from there flows to 2, 3, 4, 5, 6, the flow, however, being so slow that on looking at the tanks when filled, very little movement of the water is noticed. The time required for any given volume of water to pass through the six tanks will be about six hours, thus allowing full time for complete precipitation.

The clear effluent passes over a weir at the end of tank 6, and falls



SCALE 50 FEET TO 1 INCH.

over stone steps into the effluent channel H, which conducts it to the Blackstone River. Provision is also made, however, for removing the clear effluent from any one of the tanks. The concrete bottom of each tank inclines to the centre, where there is an opened drain; these drains are connected with the sludge-pipe K, which carries the sludge to the sludge-well L. Here the sludge is raised fifteen to twenty feet by means of a pump, and is conducted by a pipe to a sandy plot of land having an area of about twelve acres. For the present the sludge will be placed upon this land, and from time to time is to be covered with sand. This will answer for the present, but a time will soon come when it must be pressed into cakes and burned.

The sewage as it now comes to the works varies greatly from hour to hour, sometimes containing large amounts of acid liquors and iron salts, and at other times being nearly neutral, and containing very little mineral matter. Tests are made every five minutes during the day and night to determine roughly the amount of acid liquors and iron salts present, and by these tests Mr. Arthur Forbes, who is in charge of the works, and to whose intelligent oversight their successful operation is due, decides the amount of lime and sulphate of aluminium that is to be used. At times it is necessary to add 120 grains of lime to a gallon of sewage; at other times the amount is reduced to two or three grains. On the average, about two tons of lime are used each day. The amount of sulphate of aluminium added also varies very greatly, depending on the amount of iron salts present in the sewage. Very often the amount of iron sulphate present renders the addition of aluminium sulphate unnecessary. The average amount of aluminium sulphate used each day is about two hundred pounds.

As is to be expected, most of the sludge is found in the first basins; the first and second basins are cleaned every thirty hours, the third every three days, the last basin every two weeks. As has been explained, this sludge, which at present contains over 98 per cent of water, is carried from the sludge-well by a pipe-line to the large sludge basins. The water gradually sinks into the sand, and at the end of eight days the sludge contains only about 80 per cent of water, and can be easily removed by shovelling. No odor is to be perceived at the sludge basins, which is undoubtedly due to the amount of free lime contained in the sludge.

As regards the sewage, effluent and sludge I cannot at the present time present any tabulated analytical results, but the analyses I have made show that, with Worcester sewage, chemical precipitation does much more than simply precipitate out the suspended matter.

The total amount of soluble matter in the effluent is twenty per cent less than in the raw sewage, and the volatile matter is reduced from about sixteen parts in 100,000 to nine parts, and the albuminoid ammonia from eight-tenths of one part to about three-tenths. The effluent has, I think, been brought to such a state of purification, that while it would not be allowable to run it into a stream used as a water supply, it is sufficiently pure so that the organic matter which it still contains will be easily destroyed without causing any nuisance, when it is run into the Blackstone River.

Remarks of T. M. Drown, on Professor Kinnicutt's paper.

Mr. Chairman and Gentlemen: — I have listened with great pleasure and interest to Professor Kinnicutt's paper, which has presented the subject of sewage purification, both from the standpoint of historical development and of adaptation to special needs, in a most admirable way.

The idea once prevalent that it was an economic duty to utilize the manurial value of sewage on the land is now giving place to the more sensible notion, that it is a sanitary duty to get rid of sewage as quickly as possible.

There is no doubt that the simplest method of disposing of sewage is to pour it into the nearest water-course, or into the sea, and this is also the best method where it can be done safely.

In the case of a stream two considerations enter the problem: First, Is the water of the stream used for drinking below the point at which the sewage enters? Second, Is the volume of sewage entering the stream large enough in proportion to the volume of the stream, to make the water offensive to the sight or smell, or to injure the water for manufacturing purposes?

That the water of a sewage-polluted stream is not fit to drink may be assumed at the outset. It is true that in the case of large rivers, like the Mississippi, the Hudson, the Merrimac, sewage-polluted water does form the supply of some large cities. Immunity from

harm is supposed to be obtained in such cases by the very great dilution of the sewage, and also in consequence of the "self-purification of streams"—a consoling expression which had its origin in the days before we knew anything of micro-organisms and their power of producing disease.

But when a stream is not used for drinking water it may properly receive the drainage of the towns on its borders to an extent that will not make the stream a nuisance, or prevent its use in boilers, or for manufacturing purposes.

In Worcester this limit has been far overpassed, and the water of its river resembles sewage much more than the water of the lakes in which it had its origin. The question here in Worcester was not to take the sewage out of the river that its waters might be used for drinking, but simply to prevent a nuisance. And any process that will do this most cheaply and simply is clearly the one to adopt. It seems to me that the process of chemical precipitation selected will, when the system of sewerage is complete, and all the city sewage is treated by chemicals, do what is expected of it.

As most of you know, the State Board of Health has been carrying on experiments at Lawrence for the last three years in the purification of sewage by intermittent filtration. The purifying power of porous soil on organic matter, whereby it is completely oxidized, has long been known, and the sewage farms so general throughout Europe for the combined purification and utilization of sewage are instances of the application of this well-known principle.

But it is safe to say that never has there been a systematic and comprehensive series of experiments on the purification of sewage by intermittent filtration that can compare with those which have been in progress in Lawrence under the direction of Mr. Hiram F. Mills, the engineer member of the Board of Health. The report of the work of the Lawrence Experiment Station is now in press and the results obtained will shortly be available to all. I will merely say in this connection that it has been shown that sewage may be continuously purified by simple filtration through sand at the rate of 100,000 gallons per acre a day (and even higher rates have been obtained), and yield an effluent that is purer, organically speaking, than many well-waters in general use.

But this statement does not convey the idea of the real importance of the Lawrence work, which is mainly directed to determining the

conditions of successful purification of sewage by its disposal on land. For this purpose it is necessary to determine by actual experiment the unfavorable conditions, that money may not be wasted in installing plants for sewage purification on land unsuited for the purpose.

There have also been carried out at Lawrence by Mr. Allen Hazen a very thorough series of experiments on the chemical precipitation of sewage, which exceed in accuracy anything heretofore attempted.

I would in conclusion like to express my thanks to Professor Kinnicutt for his instrnctive paper, and to Mr. Allen for the description of the very complete works which he has designed and built for the city of Worcester.

Prof. W. T. SEDGWICK, of the Massachusetts Institute of Technology, Boston, spoke substantially as follows: —

Mr. Chairman and Gentlemen: — It seems to me to be a matter for congratulation that the City of Worcester has had the courage to introduce a method of sewage disposal entirely new to this vicinity, thus enabling us to observe the actual working of sewage disposal by chemical precipitation. It seems to me, furthermore, that Worcester has shown commendable enterprise in sending her engineer, Mr. Allen, to Europe and elsewhere, and in giving him afterwards the means to mature and carry out his plans. I desire to express my own personal pleasure in having been allowed to-day to witness the outcome of Mr. Allen's work. Hitherto, sewage problems have not given us very great solicitude, but as our country grows older and the density of population increases, we are bound to be confronted with new and more difficult problems of water supply and sewage disposal. And here I desire to express my thanks to Professor Kinnicutt for his full and interesting treatment of the subject before us to-day, — a subject which concerns vitally every officer of the public health and every intelligent citizen of the Commonwealth.

Among the numerous important questions arising out of this subject to which one might well address himself, I feel impelled to take up, for a moment, that in which I am personally most interested, namely, the question of the effect of the several methods of disposal upon the living organisms or "germs" in sewage. It must be distinctly understood that sewage is a decomposing fluid, and is crowded

with the germs of putrefaction. These are wholly invisible to the naked eye, although so abundant that the sewage of Lawrence, for example, contains usually more than half a million to the cubic centimeter (about a cubic — one-third of an inch). European sewage, being usually more concentrated, contains sometimes as many as five to fifteen millions of organisms to the cubic centimeter. I do not know of any bacterial analyses of Worcester sewage, and it may be that the acid which appears to be so abundant at times, may tend to diminish the number. Most of these "germs" are undoubtedly merely putrefactive and not pathogenic; but among them there may be some — like those of typhoid fever — which are dangerous disease germs. It becomes, then, an interesting question to inquire, What, precisely, is the influence of chemical precipitation upon the organisms of sewage?

For, while this question may seem comparatively unimportant if the effluent is not to be used for drinking and the end sought for is clarification rather than purification, it is quite otherwise in those cases in which the effluent is to be turned into a stream that may possibly be used at some point for drinking purposes. But even if clarification be all that is desired and purification is deemed unnecessary, there is still required a knowledge of the sewage organisms that survive in the effluent, since, if these be added to an ordinary stream, it is possible that in the presence of the residues of sewage precipitation, they may produce new and unlooked-for consequences in the main stream further on. Now it seems to me that it is this biological aspect of the question that most concerns an association like this, especially if we inquire, in the next place, What is the effect of any particular method of sewage disposal upon the disease-producing germs which must frequently occur in sewage?

At the Lawrence Experiment Station of the State Board of Health studies have been made of the two principal methods of sewage disposal, in respect to their influence upon the organisms of sewage.

The first method is that known as intermittent filtration, or the disposal of sewage upon sandy land. The second is chemical precipitation. In both methods the sewage organisms are materially reduced in numbers, but in chemical precipitation far less completely than in intermittent filtration. Very considerable concentration of the chemicals used is required if the results are to compare at all, bacteriologically, with the results obtained by simply pouring the sewage

upon finely sandy land. Now, if the object of a particular system of sewage disposal be clarification to prevent a nuisance, chemical precipitation will often suffice ; but if purification, in the biological sense, be desired, it is infinitely less satisfactory. From the point of view of the public health, there can be little question that ordinary chemical precipitation leaves much to be desired. In the absence of careful experiments in this direction with specific disease germs, the question must, however, remain an open one. It would be especially interesting to experiment here at Worcester, since, according to Professor Kinnicutt, the sewage of Worcester is made acid by receiving waste from the manufacturing establishments, and it might appear upon investigation that this directly favors or hinders the life of the sewage organisms.

It may interest the association to know that it is possible by means of only five feet in depth of finely sandy soil to purify sewage so that all organisms are removed from it. I have frequently drunk of the effluent of such a sewage filter without observing any ill effects whatsoever, and others have done the same. This probably explains why so many wells that, from their surroundings, ought to be dangerous, really produce for a time no bad effect.

But, after all, a great volume of sewage, as we find it in cities like Worcester, seldom has to be purified to this extent. It will generally suffice if it be freed from offensiveness, and here chemical precipitation is probably, at present, most useful. Some experiments at the Lawrence Experiment Station, however, indicate that the proper use of small pebbles or coarse gravel stones as rapid filters, may hereafter prove to be cheaper and equally effective.

Charles A. Allen, City Engineer of Worcester.

Mr. President and Gentlemen: — I have not a great deal to say. You have visited our works and seen the result. It might be interesting for you to know what the practical result has been upon the river. Of course when I say the practical result I mean what the effect has been as the ordinary observer notices it. We have made no analyses of what the result below Worcester has been so far, but it is a common thing for people to come into my office who live, say, down at Saundersville or Whitinsville, and say something like this: "Have you been down the river lately?" "No," I reply, "I

have not." "Well, are you aware that the river is in a much better condition today than it has ever been before?" I generally expressed surprise; and I really am surprised. But we are told by people below that the river is very much cleaner than it has been for ten years.

I would like to explain further as to the amount of sewage we are treating, and also what we propose to do. We have the combined system of sewers, which care for surface water as well as for sewage proper. Nearly all of our sewers are planned in this way; a few of them, in outlying districts, are designed to care for domestic sewage only. We treat from three to four million gallons per day of polluted brook water; and, until we can take all the sewage to be treated, we don't expect and don't claim that the river will receive the full benefit of the process. I am now at work on the plans for the separating of brook water from the sewage, and in a year, or two years, we will convey all the sewage to the works and treat it.

The question has been asked today, several times, about the disposing of the solids, and whether our process is to be a permanent method, and I have answered the questions a number of times. I'll take the risk of explaining again. The land on which we dispose of the sludge is owned by the city and is some twenty acres in extent. We have the river on the east and the Providence and Worcester Railroad on the west. There is no possible way of getting on to that land except through our grounds and the right of way across the railroad, owned by us, so that it is entirely isolated. The ultimate disposal of the sludge will be by burning it; we first decided to see what could be done by storing it. We also wanted to see whether there was any chance of the sludge becoming a nuisance, so we have let it lie there all summer without covering it up. We have never had the least trouble from it, so that, as far as that question is concerned, it is safe to say that the sludge can be run into basins and dried, without any danger of becoming a nuisance, and it can be afterwards burned. My own opinion is that, in the course of a few years, we shall burn the sludge. The present method is not a permanent one, and ought not to be so considered. It was simply a matter of convenience. The works were not entirely completed when operations were begun; there were many things that we had to hasten to construct, and the disposal of the sludge was one of them.

Now we have found out that, after all, we know very little about

Worcester sewage; that is, about how it is made up. In the first place it is very much more acid than we expected. When we began to treat the sewage we had a good deal of difficulty in obtaining an effluent that would not be more or less discolored. When we took it and put it into a glass it looked very much like amber. But we very soon found, thanks to some experiments by the State Board of Health, that the trouble was that we did not neutralize all the acid. We experimented every five minutes during the day, neutralizing the acids with lime, and there was no further difficulty in getting a good effluent. The tendency at first was to use more lime than was necessary. I think the amount now used is one-half that used at first, and the result is equally as good.

We find that it is not always necessary to treat the sewage with chemicals as it flows into the tanks. That is where we take advantage of the acid in the sewage. Perhaps I can best illustrate what I mean by explaining our method of operating the tanks. Number one is emptied in season to receive the extremely acid sewage, the flow generally lasting about an hour and a half. This sewage is thoroughly treated with lime, and the tank is filled with it; the machinery is then stopped and crude sewage is run through the tank, and is thoroughly treated by the excess of chemical matter in the sewage just preceding it. We can frequently run four or five hours in this way with good results. It is very largely a question of manipulation, where a uniform effluent is desired.

Something has been said in relation to mechanical filters in place of intermittent filtration. If your cities and towns have the same experience that we have had, when they come to the point of disposing of their sewage, you will undoubtedly have an immense number of advisers in favor of mechanical filtration. I think, however, it may be said that sewage is very little improved by mechanical filtration.

[Mr. Allen at this point passed round several samples of the sewage that had been operated upon at the Worcester sewage works.]

Professor Fuller — Is it not quite possible that that is owing to the growth of bacteria?

Mr. Allen — I think it is quite likely, Professor Fuller. I am not an expert upon that point. There is one statement I wish to correct that Professor Kinnicutt made, inadvertently, perhaps, and that is about the difference in the quantity of water running into the river and in the sewer. He said, as I understood, that there was five

times the water running in the river as in the sewer. I think he must have meant the flow of Mill Brook. Judging by the water-sheds there would be about seven times the flow of water.

The tanks are similar in design to those at Leeds, England, and are of sufficient capacity to treat a greater amount of sewage then we now have.

When we first began to treat the sewage it was in this way: Tank number one was filled and then cut out, tank two filled and cut out, and so on through the series. In that way each tank would have from six to seven hours in which to rest, and the effluent obtained was very fine, indeed. It is a very much more expensive way of doing than the present method. It takes more men, and the difference in the effluent is not such as to seem to warrant the additional expense.

I entirely agree with Professor Drown that there is no one system of sewage treatment that is to be adopted in all cases. I think, however, it has resolved itself down into two systems, because I don't imagine that irrigation will be very extensively used. When I was in England I saw Mr. James Mansergh, who was the engineer of a very large number of important works, and who is now consulting engineer for the Metropolitan Board of Health in London, and he told me that in ten years, irrigation, as a means of disposing of sewage, would be entirely done away with. So that really we have but two ways — chemical precipitation, which is the method in use in Worcester, and downward intermittent filtration.

Now, just one more point I wish to touch upon, and that is, the liability of sewage-disposal works becoming a nuisance. Undoubtedly, some of you today were looking for more or less odor at our works. It is very natural that you should. I have visited many works abroad where the odor was anything but pleasant. It is simply a matter of manipulation and care, and keeping the works in the best possible condition. It does not matter whether the works are chemical precipitation or intermittent filtration, if they are properly looked after there need be no nuisance and no trouble. Therefore I say, keep your disposal-works out of politics. [Laughter and applause.]

Mr. French (of Newton) — I wish Mr. Allen would give us a few items in regard to the cost of maintenance

Mr. Allen — I have said nothing about the cost for the reason that we are continually changing and reducing the amount of chemi-

cal matter that we use. At the time the works were decided upon we calculated to deal with three million gallons a day at a cost of $22,500 a year, and we have been able to keep the cost considerably inside of that. We have only been running three months, and that is the reason why we have not given you the cost and a chemical analysis — simply because we are just beginning operations here.

Mr. French — Does that include the cost of the plant?

Mr. Allen — No, sir, it does not; simply the operating expenses. In London the price is something like a shilling a head. It will probably be more here, for labor is higher and chemicals are dearer.

Mr. French — What has been the actual cost of the plant?

Mr. Allen — The outfall sewer cost $75,000 and the tanks and machinery about $47,000. With some additional expenses for grading and the like, the total cost will be a round sum of something like $150,000 or $175,000.

Dr. Baker — I think the gentlemen of the Association are greatly indebted to the city of Worcester for the interesting and instructive afternoon we have had here, and far more to the gentlemen who have given us such able and instructive addresses, and I, therefore, wish to move a vote of thanks to Professors Kinnicutt, Drown and Sedgwick, and Mr. Allen. I hope that some of this will reach print. I think the Society should have in permanent form the result of this report. [Applause.]

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MEMBERSHIP ROLL

JAN. 1, 1891.

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The Massachusetts Association of Boards of Health was organized in Boston, Mass., on March 19, 1890, with the following objects: the advancement of sanitary science in the State of Massachusetts, the promotion of better organization and co-operation in the local Boards of Health, the uniform enforcement of sanitary laws and regulations, and the establishment of pleasant social relations among the members of the Association. All persons holding appointments as members of a Board of Health in a Massachusetts city or town, the executive officers of such a local Board, and the members of the State Board of Health, and such other persons as may be elected, are eligible to membership. The annual dues are three dollars. This Association has four regular meetings each year, the Annual or January meeting always being held at Boston.

The Journal of the Massachusetts Association of Boards of Health is a quarterly publication containing the papers read at the meetings, together with verbatim reports of the discussion. It will also contain from time to time interesting contributions from writers of the highest standing in their profession. It affords a convenient medium for the interchange of information and experience between its members, who are so widely separated as to find frequent meetings an impossibility. Every addition to its subscription-list, therefore, is a material aid in extending its field of usefulness. All members of the Association receive the Journal in return for their annual dues; to all others the subscription is two dollars per annum. If upon inspection of the accompanying copy you feel so inclined, we should be glad to receive your subscription. Address,

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Journal of the

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OF

BOARDS OF HEALTH

Official Journal

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Combination Schoolhouse Heater,

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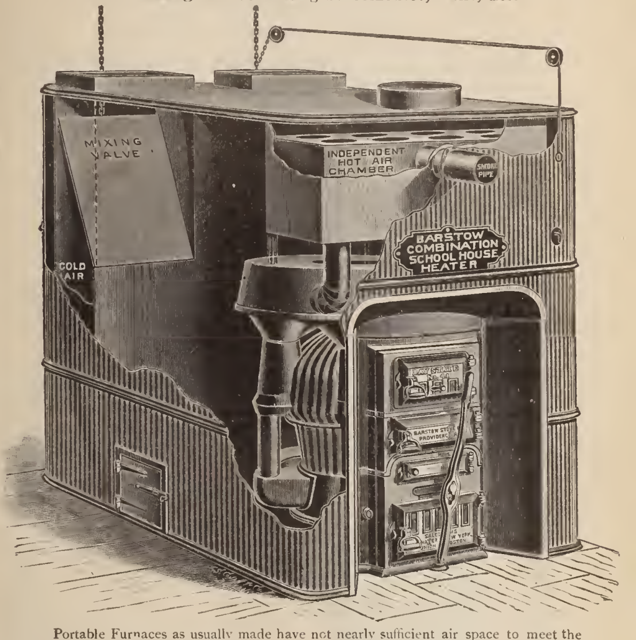

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OF

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THE PURE MILK QUESTION.

Vol. II. April, 1892, No. 2.

Massachusetts Association of Boards of Health.

Organized 1890.

[This Association as a body is not responsible for statements or opinions of any of its members.]

VOL. II. APRIL, 1892. No. 2.

QUARTERLY MEETING.

Waltham, April 27, 1892.

The meeting was called to order by the President, who announced that the first business in order was the election of a secretary pro tem.

Dr. Abbott was chosen to act as secretary pro tem.

The President. The association is fortunate in having with it to-day Mayor Mayberry of Waltham. His presence with us to-day gives us great satisfaction and we would be glad to hear from His Honor.

Hon. George L. Mayberry. *Gentlemen of the Association:* The greeting to-day properly comes from me, not from you, and in behalf of the city of Waltham I will say that I am more than pleased to be able to welcome the association here. Our local board of health is a body in which the city takes great pride, and the steady advance that they are making in keeping the city up to the requirements of the most improved methods of sanitary science is most acceptable to us, except when we come to the matter of expense, and in that we have found it necessary to tone down their ideas considerably. I have no doubt it is the same elsewhere. In fact, some of us have felt alarm at the manner in which their powers are extended more and more each year by the legislature as the legislature tries to keep pace

with scientific discoveries. About a year ago we came in contact here with the president of your association. We started in, in all innocence, to extend our water works system, — to build a larger well in order to get a larger supply, and inasmuch as we had always had a water supply here which we prided ourselves was one of the very best in the State, and inasmuch as the water had been analyzed for a series of years by the State Board of Health, in full innocence we went on and filed our petition in the State House for leave to extend the supply by enlarging the same well and getting a larger supply from the same source. In doing so, we ran across the State Board of Health. They did not propose to be ignored in the matter, and they compelled us to go through the routine of filing our plans before they would grant their permission, which they finally gave, and were no doubt intending to give at the outset. However, the association is doing a good work, and if occasionally the rest of us who are not within the inner sanitary circle kick, you must expect that; for it takes us some time to grow up to the elevated state of mind which you get in a meeting like this. We were almost astounded a year ago when our board of health told us that if we did not water our streets we would have something here before a great while which we didn't want, — nothing short of cholera or scarlet fever or something of that kind, — and of course we immediately complied with their demand. After all, we find it is an advantage in a community like ours, rapidly growing, to have a body of men who thoroughly appreciate the needs of a growing community, and who keep us up to the standard necessary in a city of this kind; and although we do not follow them as rapidly as we ought, yet we are in sympathy with them and keep up with them as well as we, with less speed and more halting step, are able to do. The work, of course, that an association of this kind can do is important, and I have no doubt that in each of your communities the power that you have has been used for the general good, and that the proper treatment of these questions of health has been, as it has been here, a great blessing to other cities; and although we do not always, as I say, follow implicitly every suggestion that is made, it is with an appreciation of the work of an association like this, and with a feeling

of interest in the objects of the association, that I take great pleasure on behalf of the city in welcoming you to Waltham.

The PRESIDENT. Is there any business to be presented on behalf of the executive committee, Dr. Durgin?

DR. DURGIN. There were proposed for membership Dr. Alexander Burr and Hon. E. J. Donovan, of Boston. The executive committee recommends the election of these gentlemen. Also, the printing committee asked the endorsement by the association of the making of a new contract for printing the doings of the association. These two items are recommended by the executive committee.

Dr. Alexander Burr and Hon. E. J. Donovan were duly elected members of the association.

It was voted that the printing committee have authority to make such contract as seems best to them for the printing of the proceedings of the association.

The PRESIDENT. The first business of the meeting will be the reading of a paper by Mr. James C. Coffey, of Worcester, on "A Local Epidemic of Diphtheria."

MR. JAMES C. COFFEY, Clerk of the Worcester Board of Health, said, —

Gentlemen : — For the benefit of the members I desire to say that at Worcester during the early winter we had in a school district there an epidemic of diphtheria which resulted in sixteen deaths out of some forty odd cases, and it created considerable excitement and ended by the Board of Health recommending the closing of a twelve-room school building, which is located here, on this plan which was drawn by an engineer in our office, between Home and Dix Streets. In answer to an order of the city council the Board of Health made a report, giving the history of the epidemic, with the facts that came to their knowledge in investigating the case. I wrote the report for the city council, and without my knowledge Dr. Woodward put me down to read the report at this meeting, and I did not know until Saturday that that was expected of me, but I had this map drawn yesterday by an engineer in our department, and I can say that it is a correct representation of that section of the city.

In this district the highest elevation is 578 feet above tide water, and the lowest elevation is 494 feet, a difference of 84 feet in about 1,300 feet, or a quarter of a mile, in round numbers, in a direct line. This portion is a hillside, which is wet and clayey, sloping to the north and west, and exposed here to the northeast winds coming across here and across this lowest part of the district. Here this district is thoroughly sewered, but on Pink Street, at this lowest point, the sewer is pretty near the surface, so much so that in one house where the water-closets are located in the cellar the sewage at times has backed up through the closets and flowed into the cellar.

Here on the eastern border of the district are some of the very best houses in Worcester, — along through Harvard Street live some of the very best people of the city, business men, and the very best class of mechanics, while down here through this portion are located the laboring classes. The houses in here are old, and have probably been standing longer than in any other portion of this district. In here are some colored people, — quite a settlement. On this street here again begins a better and a more comfortable class of dwellings than in through here.

The first case of diphtheria that occurred in that district was on Denny Street here. There was a great deal of discussion in Worcester as to whether the epidemic was caused by the defective conditions existing in this schoolhouse, or whether the sanitary condition of the house and the people who lived there were responsible for it. This first case was that of a married woman, 28 years of age, and it was reported on May 20th of last year. Case No. 2 was reported from Bowdoin Street in June, and as you can see was in no way connected with case No. 1, in this locality. This was the case of a child 8 years of age, and it resulted in death. Case No. 3 was reported from the same street, Bowdoin Street, June 16th, ten days after case No. 2, and was that of a child of school age, a girl 7 years old, who recovered. This was the last case before school closed for the summer vacation. During the summer vacation seven cases were reported, resulting in three deaths. The first of these cases was reported fifteen days after the closing of the school; and twenty-five days after case No. 3, case No. 4 was

reported, — that of a girl 6 years old, on Dix Street, in a different section of the district. Cases Nos. 5, 6, and 7 were reported from Pink Street. July 25 and August 6, and cases 8 and 9 were reported from Lily Street. Those are both short streets and practically the same class of people live there and have more or less intercourse with each other.

Cases 6 and 7, 8 and 9, and case 10, reported from Pink Street and Lily Street, were in the immediate vicinity of case 5, and investigation showed that these children had been playing together in the street. Case No. 11 was reported from Harvard Place on the 8th of September, the first case after the opening of the school after the summer vacation, on the very day the school opened, in fact, and twelve days after the report of case No. 10 from an entirely different section. As I told you before, the people in this locality have very little to do with these people down here in the neighborhood of Pink Street. It is a different section and a different class of people. Case No. 12 was reported from Pink Street twelve days after case No. 11, and was in the immediate vicinity of cases 5, 6, 7, 8, 9, and 10. This child had never attended school, and was a Swede child that had been in this country only two weeks.

Case No. 13 was reported Sept. 23d from Wachusett Street, three days after case No. 12, and from a different section. This was the first case reported after the summer vacation of a child attending school. October 12th the 14th case was reported from Dix Street, and was that of a boy attending the Dix Street school. Case No. 15 was of a child too young to attend school, but a member of the same family as case No. 14. Case No. 16 was reported 13 days after case No. 15, with which it could have had no connection, case No. 15 being that of a child too young to attend school. This child was a child of school age and recovered.

The length of time which elapsed between cases 16 and 17 affords no ground for connecting these cases together. Case No. 17 was reported November 20th from Denny Street, seven days later than the last previous case. There might possibly have been a connection between these two, as they lived in the same vicinity, but the sanitary condition of the houses in which both these cases occurred was bad.

Case No. 18 was reported from John Street Avenue, December 11th, 21 days after case No. 17. It appeared upon investigation that this child was in school with sore throat several days before she came down with diphtheria. If you will bear that case in mind you will see that in this report it has a certain significance. The plumbing and drainage system of the house in which this child lived was very bad.

Case No. 19 was reported from William Street, December 19th, eight days later. The plumbing and drainage system of this house was bad. Case No. 20 was reported from Home Street, December 25th. This child was not of school age and was from a family having no other children in school. The sanitary condition of the house was fair. Case No. 21 was reported December 30th, five days after case No. 20, and eleven days after case No. 19, the last case of school age which preceded it; and it resulted in death. The plumbing and drainage system of this house was very defective.

Cases 22 and 23 were reported together from a family on John Street, January 2d, three days after case No. 21. One of these was a boy of six years and the other a boy of one and a half years; the eldest died. He was of school age and had been in attendance at this Dix Street school. The plumbing and drainage system of this house was defective.

Case No. 24 was reported from William Street, January 4th, two days later, and was that of a child of school age. Case No. 25 was in Pink Street in the same vicinity as cases 6, 7, 8, 9, 10, and 12. This child was not in attendance in the Dix Street school. It was an attendant of a parochial school in another part of the city. Case No. 26 was reported from Wachusett Street, another section of the district, on the same day as case No. 25; and cases 27 and 28 were two children of different families, both attendants at the Dix Street school. One of these resided on Goulding Street and the other on Dix Street. They are very close together, as you will see by looking at the plan. This family had two cases, and both children died, one a boy of fourteen years, and the other a girl of six.

Case No. 31 was reported from North Ashland Street, January 18th, — a different section of the district, as you see. This child was not of school age. This case was followed January

23d by three cases, West Street, Lancaster Street, and Dix Street, all of whom attended the Dix Street school. In this Lancaster Street house there were in all three cases, — two children, who recovered, and after their recovery, the mother, worn out with nursing and anxiety, contracted the disease and died.

Case No. 35 was reported from North Ashland Street, January 25th. That was the second case in that same house, although in a different family. These were colored people, and the day our inspector called there to placard the house, he found the child dead and the room filled with people, other children, and adults. He ordered them out. Subsequently another child, in another family in the same house, came down with the disease. That was January 29th. On that day the Board voted to recommend closing the school.

It will be seen that from December 11th to the closing of the school, a period of about six weeks, 21 first cases in families occurred. In these are included three cases who were ailing at the time of the closing, but were not reported for a day or two thereafter.

Since the closing of the school, an equal period of time, but three cases have been reported: two of these were children in the same family, one two years and the other six months of age, both, of course, too young to attend school. The third case was that of a young lady 21 years old.

This school had the Smeed System of dry closets and ventilation. It was put in some five or six years ago and was one of the earliest school buildings in the city to be supplied with that system. It was an old, twelve-room brick building, and it was adapted as well as it could be to the new conditions. In this system as originally applied the air is taken from the outside, carried in and warmed over a heating surface, and through flues forced into the room at about midway of the walls. The foul air is taken from the base of the rooms along by the mopboards and drawn down into a central chamber in the basement. It is taken by means of a heated flue across the vaults, where the excrement drops on to the wire screens, and passes up through the building. The idea was to dry the excrement by this foul air sucked out of the rooms, and also dry the urine in

the same way, but as a matter of precaution there was a connection with the sewer on both sides of the building, on the girls' side and on the boys' side, for use in case the air did not thoroughly dry the liquid matter.

Now, we found on investigation that there was a day during the fall that the fires were allowed to get down so low, and the atmospheric conditions outside being suitable, the foul air instead of going out and up through the building was forced back over the vaults and up through the foul air ducts into the rooms occupied by the children, driving them out on the lower floor of the building. I found that out on investigation, by making inquiries, and the thought naturally presented itself to me, if that were true in the autumn would it not be necessarily true at night, when there was nobody in the building, and the fires would perhaps become low and the atmospheric conditions suitable to beat it down? I found that during the summer vacation when the school was not occupied and the fires were all out, that that odor from the vaults was very strong in those rooms; and consequently we recommended the entire cutting off of the rooms from any connection with the vault system, and that foul air be carried into particular places constructed for the purpose and carried out without carrying it over the fecal matter in the vaults. We also recommended that in the vault be constructed a latrine. All our recommendations were carried out.

Under the direction of the local board the building was thoroughly fumigated. We sent three men over and made the building as air tight as possible; we covered the ventilators on the roof and made them as tight as possible, and then with cotton batting three men spent two days in the building, making it as thoroughly tight as it could be made, after which we burned some 700 pounds of sulphur in the different rooms. We put it into the basement, in the ventilating shaft, where the cold air was taken in, and then up in the lower rooms. All of the floors were washed with a solution of corrosive sublimate, and the walls were scraped and repainted and the desks revarnished. There were two of the rooms where children of the first grade were in attendance in which the majority of cases occurred that were directly over these vaults. There were ten

cases in one room, and six in another, directly over the vaults. The desks in those rooms were all taken out and new ones substituted therefor, and the books in those rooms were all burned.

Of course, as you are aware, under the free text-book act the books are owned by the city and are used by the children in common. Those books we recommended burning and that was done.

Now, this system of dry closets was the system as originally put in. This company does not at present put in the system in that way; that is, in this part of the country, they do not have any connection between the vaults and the room. The system is controlled by a number of different firms who have bought patent rights for different sections of territory, but I am informed by the district police that there are none of these put in in that way now, where the vaults and rooms are connected, that they are now entirely separate.

I do not know that I can add anything further to this except that as I said, this is a wet, clayey soil, and that here is a place that water stands. I have frequently seen water standing there an inch to an inch and a half in depth on that field, and it is a common occurrence in the evening after rains to see fog rising in through here. This is the lowest point; to the northeast there is no elevation, on the west is the hill on which the Technical Institute is located: so that in here is a valley with a northeastern exposure, and there is no shelter at all for that section.

Since the school has re-opened we have had in the district some five cases. Three of them were down here in this section of children too young to attend school, babies, in fact, from one and a half to three years old, and up in here we have had two cases reported, a mother and daughter, the latter a child of school age, who did not attend this school, and from whom the mother contracted the disease.

That district for the first time in many months is entirely free from the disease, or at least there is but one case and that case is convalescing. In all, counting the cases since school re-opened, we have had 51 cases in that district, with 18 deaths, about thirty-three and one third per cent being fatal.

The President. Several gentlemen have agreed to say something in connection with this topic, and I am going to call upon Dr. W. H. Prescott.

Remarks of W. H. Prescott.

Mr. Chairman and Gentlemen: — When Dr. Durgin asked me to come out and speak he thought the question of the differential diagnosis of diphtheria would be the one that would occupy your attention most, and that was the subject upon which he wished me to speak.

It is surely one of the most uncomfortable things a man has to do to make a diagnosis of a contagious disease, especially if he is not sure of it. It entails a good deal of expense upon the patient's family and upon himself, and unless you are sure of your diagnosis it is pretty hard to say that you think it is diphtheria.

I think most physicians feel the only disease with which diphtheria is liable to be confounded, — non-contagious disease, I mean, — is tonsilitis, especially in those cases where the soft pultaceous masses and particles run together, making a large mass, perhaps the size of your finger-nail, on the tonsils there being a good deal of constitutional disturbance. In such cases as that the points to which a physician would naturally look for the purpose of making a differential diagnosis are the enlargement of the glands about the angle of the jaw, the ease with which he can remove the mass if it be tonsilitis, the difficulty if it be diphtheria, and the tendency to spread if they are let; but they are very difficult cases at times. If the case clears up in twenty-four hours, as it very often does, the diagnosis is clear, but often one has to keep from making a diagnosis for that length of time and sometimes longer.

But there are other cases that may be mistaken for diphtheria.

The most common one, I think, is syphilis, and very often the diagnosis of diphtheria has been made when it really was syphilis. The differential diagnosis between the two is very difficult and sometimes impossible without the element of time. The diagnosis of syphilis is seldom at any rate made in the case of a young child. It is more apt to occur in the acquired form and in an adult. Therefore the matter of age is the principal differential diagnosis at first. Then the fact that it is more common that the trouble is one-sided in syphilis and spread rapidly in

diphtheria is another element. But sometimes it is absolutely necessary that no diagnosis shall be made for twenty-four to forty-eight hours. Another disease with which diphtheria is sometimes confounded is herpes of the pharynx, which is a very rare disease, but which does occur, and two cases of which I have seen. Both cases were diagnosed and sent to the City Hospital, where I was then, as diphtheria. I do not know why, but for some reason I do not think it was diphtheria; there was something about it that did not look exactly like diphtheria, and I refused to put it in the diphtheria ward. It was such a suspicious case that it was taken into the hospital and put into a room by itself in our isolating ward, and quite a number of the men on the staff saw it, and there was no doubt that it was a case,—that both of them, for the same history applies to both, —that both of them were cases of herpes and not diphtheria, and the differential points were that the masses, which looked something like membrane, could be scraped away leaving instead of a fresh, bleeding surface, an old surface,—ulceration, —which looked like one of the indolent ulcers which are sometimes seen on the outside of the lip. And then, they never come together, they never spread at all, their edges are slightly raised, but not reddened in the way that appears when you have a diphtheritic patch.

Another disease that is sometimes mistaken for diphtheria is cancer of the tonsil, which I have seen mistaken twice, and where the death of the patient, months afterwards, from the disease, proved the correctness of the diagnosis. In that case the diagnosis was made on the follicular character of the disease, the fact that the tonsil was spongy; it was clotted and more spongy than it is in diphtheria, and the slough went deeper than as a rule it does in diphtheria; but, after all has been said about the diagnosis and the diseases that can be mistaken for diphtheria, the fact remains that it is often very difficult, impossible, I think, to make an absolute diagnosis between diphtheria and some of the diseases with which it is often confounded.

Then the differential diagnosis between diphtheria and what is called membranous croup has often come up and has caused a great deal of trouble. In the last number, or one of the last numbers, of the *Lancet*, Dr. Martin reported six cases of diph-

theria in which he had done tracheotomy. In one of them there had never been the least sign of any membrane in the throat or anywhere else, although there had been laryngoscopic examinations and microscopic. The child finally died after laryngotomy, from diphtheria. The doctor examined carefully the lungs, the throat, the trachea, and no membrane could be seen. He then examined it with the microscope, and numerous flakes of membrane were seen just above the vocal cords, I forget just where, and in that membrane were Klebssobacill, making the diagnosis absolutely sure. In another case that I remember that was sent to the hospital by two physicians who were experts in this branch, they were sent in as a case of laryngeal obstruction for operation. There was only one place to put it for operation, and that was in the diphtheria ward. The tube was inserted but did not bring relief. The trouble increased, making the diagnosis of diphtheria absolutely sure, although there was nothing in the throat or in the larynx or any part visible to the laryngoscope.

So it seems to me that all cases of suspected diphtheria should be considered diphtheria until the element of time has come in to make the diagnosis sure.

Dr. Durgin. I would like to ask Dr. Prescott as to his idea of attempting a differential diagnosis between diphtheria and the so-called membranous croup, — if he recognizes a difference which is capable of demonstration in any way?

Dr. Prescott. I do not believe there is any difference at all. I believe that every case of membranous croup is diphtheria, and the reason there are so many cases put down as membranous croup is because the membrane cannot be seen; but in the case I referred to that was reported by Dr. Martin in London you could not see any membrane at all, but it was diphtheria without any question. It does not seem to me there can be any such thing as membranous croup without being diphtheria. There is croup without any diphtheria, but no membranous croup.

The Chairman. I will now call on Dr. McCollom.

Remarks of Dr. J. H. McCollom.

Mr. President and Gentlemen: — I have been very much interested in the paper of Mr. Coffey, and also in the remarks

of Dr. Prescott. I think that the danger of contagion from mild cases of diphtheria is not fully appreciated by the public at large. Children, who have these slight attacks, attend school during the whole course of the illness and thus become potent factors in causing the spread of the disease. A short time ago I made an analysis of some 11,000 cases of diphtheria that occurred in Boston during a period of five years, and it was very interesting to note the marked diminution in the number of reported cases in vacation time as compared with those reported during term time.

Diphtheria of the lungs, which is frequently mistaken for croupous pneumonia, is another source of contagion which has not received proper attention. Some three or four years ago Dr. Thayer, of Brooklyn, N. Y., published a very instructive pamphlet on the relation of pneumonia to diphtheria, in which he showed conclusively that many cases of supposed croupous pneumonia were in reality cases of diphtheria of the lungs. Of course, during life, it is impossible to diagnose these cases with any degree of accuracy; but the fact of their existence may often explain an outbreak of diphtheria in a given locality.

Domestic animals, particularly cats, are frequently a source of contagion.

In the *Sanitarian* of August, 1891, is a valuable paper by Dr. E. Klein, of London, entitled "A Contribution to the Etiology of Diphtheria," in which the author cites several instances where cases of diphtheria in children were directly traced to the disease in cats. It is important to observe, as bearing on the subject of diphtheria in the cat, that in this animal the disease in its symptoms and pathology is a lung disease, and for this reason has been overlooked by many observers. Cows may have diphtheria, and when ill with this disease may communicate it through the milk. The conditions of cows ill with diphtheria, as described by Dr. Klein in the article just mentioned, is as follows: —

"Two milch cows were inoculated with a broth culture of the diphtheria bacillus derived from human diphtheria. In each case a Pravaz syringeful was injected into the subcutaneous and muscular tissue of the left shoulder. On the second and third days there was already noticed a soft but tender

swelling in the muscle and the subcutaneous tissue of the left shoulder; this swelling increased from day to day, and reached its maximum about the end of the week; then it gradually became smaller but firm. The temperature of both animals was raised on the second and third day, on which days they left off feeding, but after this became apparently normal. Both animals exhibited a slight cough, beginning with the eighth to tenth day, and this gradually increased. One animal left off feeding and ruminating on the twelfth day, 'fell in' considerably, and died in the night from the fourteenth to fifteenth day: the other animal on the twenty-third to twenty-fourth left off taking food, 'fell in' very much, and was very ill; it was killed on the twenty-fifth day.

"In both animals, beginning with the fifth day, there appeared on the skin of the udder, less on the teats, red raised papules, which in a day changed to vesicles, surrounded by a rim of injected skin; the contents of the vesicles was a clear lymph, the skin underneath was much indurated and felt like a module; next day the contents of the vesicles had become purulent, *i. e.*, the vesicle had changed into a pustule; in another day the pustule dried into a brownish-black crust, with a sore underneath; this crust became thicker and larger for a couple of days, then became loose and soon fell off, a dry healing sore remaining underneath. The whole period of the eruption of papules leading to vesicles, then to pustules, and then to black crusts which, when falling off, left a healing dry sore behind, occupied five to seven days. The eruption did not appear in one crop: new papules and vesicles came up on the udder of one cow almost daily between the fifth and eleventh day after inoculation, in the other cow between the sixth and tenth day; the total number of vesicles in the former cow amounted to about twenty-four on the udder, four on the teats; in the latter they were all on the udder and amounted to eight in all. The size of the vesicles and pustules differed; some were not more than one eighth of an inch, others larger, up to $\frac{1}{2}$ $\frac{3}{4}$ of an inch in diameter; they had all a rounded outline, some showed a dark centre. From one of the above cows on the fifth day milk was received from a healthy teat, having previously thoroughly disinfected the outside of the teat and the milker's

hand; from this milk cultivations were made, and it was found that thirty-two colonies of the diphtheria bacillus without any contamination were obtained from one cubic centimetre of the milk."

Examples are given by careful observers of the importation of diphtheria by turkeys and also by pigeons. It is probable that diphtheria may occur in all domesticated animals.

Regarding the question of the differential diagnosis of tonsilitis and diphtheria.

I think that it is frequently impossible to decide definitely for the first two or three days of the illness, between the two diseases. Again a case when first seen may present all the typical attacks of tonsilitis, but in a day or two the diphtheritic membrane may become manifest. These obscure cases occur so frequently in practice that I have come to look upon all cases of sore throat with grave suspicion. As illustrating this point the history of a slight outbreak of diphtheria in an institution in a neighboring State may not be amiss.

A patient was admitted ill with a supposed case of tonsilitis, and in a short time four or five persons, who had been in intimate relation with the first, were taken ill with diphtheria. The drainage and hygienic conditions of the building were examined and found to be satisfactory. After the recovery of the patients the premises were very carefully disinfected. In about six months a second patient with a slight sore throat was admitted, and there was again an outbreak of diphtheria in this institution.

A few years ago at one of the summer hotels in this State, where particular attention had been paid to drainage and to all the details of hygiene, there was an outbreak of diphtheria, which could be traced, without much doubt, to a mild attack of so-called tonsilitis.

In Dr. Abbott's valuable paper on diphtheria in Massachusetts the significant statement is made that the chief characteristics of the four towns in which there were no deaths from diphtheria were their inaccessibility. None of them were near a railway line. One is separated from the State by a high range of hills; another is an island.

When there are so many avenues for direct infection from

human beings and from the domestic animals ill with the disease, it seems much more reasonable to consider contagion as the cause rather than imperfect drainage.

Mr. Coffey stated in his paper that no attempt was made to disinfect the school books. I think that this is a matter that requires the careful attention of every member of a board of health. That contaminated books are active agents for spreading the disease must be admitted by all. How we can render these books harmless I am unable to say.

The importance of recognizing the fact that membranous croup and diphtheria are one and the same disease, and that isolation is as necessary in the one as in the other, is very great. Before reports of cases of membranous croup were required in Boston, it was of frequent occurrence that a death from croup, so called, would be followed by an outbreak of diphtheria in the same family.

A great deal has been said, of late, about the increase in the number of cases of diphtheria in Massachusetts. Regarding the increase in the State at large I am unable to speak, but in Suffolk County for the 30 years previous to 1857 the ratio of deaths from croup, putrid sore throat, and epidemic sore throat, to the living, was as great as that from croup and diphtheria for the past thirty years. The terms "putrid sore throat" and "epidemic sore throat" do not appear in the registration reports for the last thirty years. The fact is, diphtheria was even more prevalent forty years ago than now, but it was not recognized as a distinct disease, and, therefore, does not appear on the registration report of that time as a cause of death.

The fact, as the experiments of Klebs and Lœffler prove, that the sound mucous membrane will not absorb the diphtheritic poison, explains why diphtheria is so frequent a complication of scarlet fever and measles. I am inclined to think that mild attacks of diphtheria during the course of scarlet fever and measles are of much more frequent occurrence than we are apt to believe. The importance of isolation in diphtheria is acknowledged by all, but there is much diversity of opinion regarding the length of time that isolation should continue. It seems to me that a period of at least seven days should elapse, after all morbid appearances have disappeared from the throat,

before the patient can be considered free from the disease, and therefore no longer a source of danger to the public.

The PRESIDENT. Dr. Prince and Dr. Woodward are unfortunately not here. The whole subject is open for discussion, and it is hoped that the members of the association will discuss it freely from their particular point of view.

MR. COFFEY. I would like to have some of the physicians here relate what experience they have had as relates to the effects of soil upon this disease. I confess that my experience of nine years has led me to attach a great deal of importance to the condition of the soil and the exposure. I know of two districts in Worcester, the sanitary condition of which is very poor, one of these is in the oldest section of the city where the people are the very poorest, and the soil is sandy, a veritable sandbank, in fact. The other is on a hillside with a northwestern exposure, where the soil is of a rocky nature, and where there is good drainage. In one of those districts, although it is the poorest in the city, we have almost no diphtheria at all, — in looking back in the records since 1884 when we first began to have the cases of diphtheria reported, I do not remember any case in that district with the sandy soil. In the other I haven't any recollection of but one case. Now this district which you see on this map is one of the best we have. With the exception of that very lowest part the population is composed of the very best mechanics in the city. The houses are all good, and cost from $3,000 to $9,000 each, some of them occupied by mechanics and some of them by business men. There is another district in the city, the very heart of the city, that is occupied by the laboring classes, the poorest working people in the city and the oldest settled portion, down through which Mill Brook, the main sewer of the city, runs, where we have scarcely any diphtheria. That is a gravelly soil, while in this district it is a wet, clayey soil: and there is another district in the southeastern part of the city with somewhat similar conditions, mechanics and a very fair class of houses, but the same natural conditions: wet, clayey soil, rather swampy. We have diphtheria there regularly. Nearly every year we have some cases: so that those things, as I say, coming to my knowledge while I have been acting as chief inspector, lead me to think that the soil has a great deal to do

with it: and in addition to that a book came into my possession lately, a book which I saw in the possession of Prof. Sedgwick, by Dr. Thorne, of England. It was on diphtheria. He attaches a great deal of importance to soil, — in fact more importance to soil than to any other single thing, I think. Did you read it, Professor?

Prof. Sedgwick. Not from that point of view.

Mr. Coffey. Dr. McCollom's remarks, and those of Dr. Prescott, brought to my mind the fact that I forgot to say in my talk that several of these cases — I believe I did allude to one of them as having been in school several days with a sore throat. Now, there were three or four of those cases that were not reported until the day that death occurred. The patient had been attending school for several days with symptoms of sore throat, the family regarding it as an ordinary sore throat. I have in mind a girl of 15 years of age that was in school up to within two or three days of her death, and was kept from school only to help her mother do the washing. She had been troubled with sore throat for some time. None of these gentlemen who discussed the subject alluded to this question of soil, and, as I say, my attention has been attracted to it by my experience in Worcester, which has led me to believe that certainly in Worcester it seems to have some effect, and I did not know but that the large experience that Dr. McCollom has in Boston might have given him some information on these matters that would be of interest. I would like to inquire how many cases of diphtheria you have in the Back Bay district. Is it very prevalent in that district?

Dr. McCollom. In reply to Mr. Coffey's question I would say that the ratio of cases of diphtheria to the thousand of population is not much higher in the poorer parts of the city than it is in the better. For instance, the ratio for 1891, in ward 11, was one to the thousand as compared with that of ward 6, which was two. It must be borne in mind that ward 11 has an average population of 51 to the acre; that the houses have the modern sanitary appliances; and that the majority of the residents are out of town during the summer months, while in ward 6, with an average population of 90 to the acre, the houses are old and filthy, the sanitary appliances are de-

fective, and the residents remain in the city during the entire year.

Although a clayey soil, damp houses, filthy cellars, and defective drainage may have an indirect influence on the prevalence of diphtheria by rendering people living in such houses more susceptible to contagion, I think that we must look on personal infection as the most potent factor in the spread of the disease. The point that I wish to establish is this, that we must not consider that when the sanitary conditions of the dwellings have been improved that we have done our whole duty, but that the most important part of the work of stamping out the disease is to reduce all chances of contagion to the minimum. As bearing on this point it is of interest to note that in ward 1, East Boston, which is situated on a hill, there is much more diphtheria than in ward 2, situated on the flats, the sanitary condition of which is far from satisfactory.

The book of which Mr. Coffey speaks is an extremely valuable one. Notwithstanding, however, the arguments advanced in it, my experience in investigating the cases of diphtheria in Boston for the past few years teaches me that we must look to contagion and not to imperfect drainage for the cause of the spread of the disease.

In point of fact only about fifty per cent of the houses, in which diphtheria occurs in Boston, have defective drainage.

Mr. Coffey. I want to say one word more, Mr. President. I do not wish to be understood as having said or believing that wet soil causes diphtheria nor understanding Dr. Thorne to say so. I do not believe the soil causes diphtheria. There must be the germ there to cause diphtheria. What I do believe, or what I have been inclined to believe, is that in this wet soil the germ was probably more prolific, that it would cultivate the diphtheritic germ in larger quantities, and that this living in a particular district where those conditions prevail would by reason of this dampness render the people more susceptible to take the disease. That is the meaning which I think Dr. Thorne intended to convey, and that is what my own experience leads me to think.

I agree fully with Dr. Abbott about these dry systems for public school buildings. I do not believe in them. I believe the

perfect system of sewer disposal is the water system, where you have sewers, and in this case we would not approve of this school being opened until they had connected it directly with the sewer; and under the seats in that school they suspended a latrine leading directly to the sewer, thoroughly calked and made tight, with a filling tank containing fifteen gallons of water, worked antomatically, and which can be regulated to be operated fast or slow; and this fifteen gallons can be sent to the sewer, and the matter carried away directly to the sewer. That was erected directly in that vault, and around and about it is open for inspection; you can get in and around it and see every portion of it; the janitor can get in there and wash the entire vault out if by any chance any matter should get spilled over the side. I think now with the system of drainage and the system of ventilation we have pretty near a perfect system, although I think the best system is where the closets are in an annex not connected with the schoolroom except by a covered passageway open at the sides.

The fact that in Worcester the most of the cases of diphtheria are in districts where the sanitary conditions are good, is a point that will bear investigation; for it is a fact that where the houses are provided with fair sanitary appliances, we have this condition of things, whereas, in the case of other houses, many of them are found to have defective drains, and yet we do not have any reports of diphtheria from that section. I want to refer to this book of Dr. Thorne's. After going over this subject and investigating a number of epidemics in England, Scotland, and Wales, he has come to the conclusion that the soil has a great deal to do with it; and he cites a number of medical gentlemen who have investigated the snbject, some of whom question whether the soil itself has so much to do with it, but say that it may be due to the rise and fall of the ground water in the soil: and one authority whom he quotes is of the opinion that perhaps the diphtheritic germ is in the soil, and the rise of the water forces that out into the air, and, of course, incidentally, the people who are living in the vicinity of the wet soil, being subjected to this, are rendered more susceptible. Of course their bodily energies are lowered, and therefore they are in a condition more easily to contract disease; and I am cer-

tain, after my experience, that the soil, or the rise and fall of the ground water in the soil, has a good deal to do with it. And he said, too, that some instances had been cited where epidemics have occurred where the surface soil was gravel or sand. He said that might be true, but underneath that surface of gravel was a hard clay which rendered that really a cistern, and that the water did not get a chance to leach off or run away. I think it is a book that might be read with a great deal of advantage by health officers.

Mr. Coffey. I would like to ask Dr. Durgin if he would consider that defective drains had an effect upon the health of the family? For instance, physicians come to me and say they would like to have a certain house investigated, that they have been having repeated cases of sore throat, — not diphtheria, but sore throat; they have had them this year and last year and year before that, and they ask us to examine the drainage of those houses and see if there is not something wrong; they say the cases do not seem to yield to treatment, and that the general health of the people is running down, and we send an inspector to such a house and usually find it in a defective condition.

Dr. Durgin. I think that it is a very common experience in our cities for physicians to find repeated attacks of sore throat, which do not mend by treatment, and the board of health is asked to examine the house, and it is a common experience to find the drain defective. I think it is accepted in the profession that there is a suspicious connection between broken drains and sore throats. It is well recognized that where there is an irritated throat the diphtheritic poison takes effect much quicker. A sore throat is more likely to be attacked by diphtheria than a healthy throat. A case occurs to me which I saw a few weeks ago in a child ten years old. I saw it on Sunday evening and Monday morning. On Sunday evening it had a temperature of 103, with a pulse of 120, and appeared quite sick with a simple tonsilitis. I saw it the next forenoon and the temperature had dropped to normal and the pulse to 84; the throat had changed so much and the child appearing so well I told the family I would not see it again unless something new appeared. The child continued to improve for five days and

was quite well, when the child again became ill and they sent for me, and I then found a plain case of diphtheria.

It seems to me that such cases are not uncommon and rather indicate that the sore throat presents the most favorable condition for the lodgement of the diphtheritic poison.

Dr. Prescott. I was for nearly three years in the admitting office of the Boston City Hospital, and in that position I saw a great many cases of membranous croup which were sent in there for operation. I never saw one in which there was not membrane, either in the larynx or below the larynx, which was found at the time of operation, and it does not seem to me possible that there can be any case of membranous croup which is not identical with diphtheria, although there may be cases of diphtheria which are not dependent upon Klebs-Lœffler bacillus.

Dr. Abbott. Perhaps we should come to a better understanding in this whole matter, if we make a sharper distinction between causes and conditions. If, for example, you put a half-dozen children of different ages, some of them quite young, into a small tenement of one or two rooms, together with their parents, and in these rooms they eat, drink, sleep, and cook their food, and are born there and die there, we are more likely to find diphtheria spreading under such conditions, than in a large and roomy house in which the occupants are few in number. We are apt to say that overcrowding and damp cellars are causes of diphtheria; I do not think so, they are merely conditions. If the father of a large family comes into his little home from a crowded horse-car where he has been exposed to infection, and sits in a small room among his children, he is far more likely to spread infection than he would be in a larger house with better conditions. These conditions are no more causes of diphtheria than is the soil in which a tree grows the cause of the tree. The real cause of the tree is the seed. If you furnish the seed with light, air, heat, and moisture it will grow and become a tree. The same is true of the germs of diphtheria, if you furnish them with the proper conditions they will flourish.

One thing attracted my attention in connection with the schoolhouse at Worcester, which also applies to many of these new systems of ventilating public buildings, and that is, the liabil-

ity of spreading a considerable amount of noxious and infectious material throughout the neighborhood. Here were 500 children whose excreta was deposited in one place in the basement of the schoolhouse. The fecal matter is dried by a current of air, at not a very high temperature, and a portion of it must necessarily be distributed out-of-doors. It is not disinfected; it is simply dried. The germs of disease are not necessarily destroyed by drying; some are thus affected more than others. If this is simply a possible danger, it is worth while to make it a matter of further investigation. Where a schoolhouse is located in a city having a good system of sewers, there is no excuse for having it disconnected from the sewerage system.

The sewer was intended to receive excreta, let it go there.

It seems to me that the best method of treating books which have been in an infected house is to burn them. The books are not worth much: the life of a child is of more consequence than the books, and the same is true of many of the books in the public libraries. Books that are old and of little value may be destroyed. In actual practice I have treated some books which were too valuable to destroy, by baking them in an oven heated to a temperature of not over 300 degrees Fahr., spreading the leaves in such a manner as to allow the heat to reach all parts of the book. Special care would be necessary in the case of books with rich bindings.

The PRESIDENT. The next subject is "Dairies and Cow Stables." Dr. Durgin will read something:

DR. DURGIN. I will read a text for the next topic for discussion, in the form of a regulation recently adopted by the Boston Board of Health, adding merely that the danger to which our milk supply is exposed by the careless methods of production and handling, seems to us to call for immediate and practical work. The regulation is as follows: —

"Whereas, cows' milk is one of the most common and necessary articles of food, and is oftentimes seriously impaired in usefulness and rendered dangerous to health by the want of proper care in its production or subsequent treatment or handling, it is, therefore, ordered that the following regulations be and are hereby adopted: —

"*Section* 1. — No person shall use any building as a stable for cows, unless it contains at least 1,000 cubic feet of space for each animal, is well lighted and ventilated, has tight roof and floors, good drainage, a supply of pure water and all other necessary means for maintaining the health and good condition of the cows, and has been approved by the board of health.

"*Section* 2. — Every person using any such building shall keep the same and the premises connected therewith, and all land used for the pasturage of the cows, clean and free from filth.

"*Section* 3. — Every person keeping a milch cow shall permit it to be examined from time to time as to its freedom from disease by a veterinarian designated by the board of health.

"*Section* 4. — No person having an infectious disease, or having recently been in contact with any such person, shall milk cows or handle cans, measures, or other vessels used for milk intended for sale, or in any way take part or assist in handling milk intended for sale until all danger of communicating such disease to other persons shall have passed.

"*Section* 5. — No person shall sell or use for human food the milk of a diseased cow, or permit such milk to be mixed with other milk; nor, until it has been boiled, sell or use such milk, or any mixture of such milk for food, for swine, or other animals."

The President. — Dr. Peters, we shall be glad to hear from you.

Remarks of Dr. Austin Peters.

Mr. Chairman and Gentlemen: — I was unaware until a day or two ago that I was expected to make any remarks upon this subject, when I received a notice to the effect that "Dairies and Cow Stables" would be discussed by Drs. Austin Peters and Alexander Burr. Since then I have been very busy and have thought that I would not even have time to be here to-day, and consequently have not prepared anything to say, so I shall have to ask your indulgence if I confine myself simply to a few facts that I know.

I know that cows have tuberculosis; I know that a cow with

general tuberculosis and a healthy udder, or that a cow with a tuberculous udder, may give the bacillus of tuberculosis in her milk ; I know that giving that milk to man or beast for food will produce the disease in them to the extent of forty or fifty per cent, or at least it will in calves and pigs, so I do not see why it will not in mankind. The bacilli can be demonstrated to be present in the milk by means of a microscope in many cases, and in other instances it may be present, but in such small numbers as to escape detection by a microscopic investigation. I also know that in the outskirts of our large cities, particularly in the eastern part of the State, there is among dairy cows a considerable amount of tuberculosis. I am only sorry that the new regulation of the Boston Board of Health does not apply to a larger area than that contained in the limits of the city, as while there are a number of cows kept within the city limits, yet the bulk of the milk supply comes from the adjoining country. In considering the prevention of tuberculosis among humans, forbidding the sale of milk from tuberculous cows in an uncooked state is only stopping up one small loophole, and there are other steps that might be taken in the future towards checking its ravages, either by means of statute or by popular education, such as not allowing healthy and tuberculous people to sleep together, also preventing tuberculous persons from expectorating in the streets, cars, and public places as they do, the bacilli which they cough up drying and forming part of the dust of the air blowing about and infecting others. There should also be regulations requiring the disinfection of rooms or tenements, which have been occupied by consumptives before allowing healthy individuals to occupy them. I doubt if the milk from tuberculous cows causes more than five per cent of the human tuberculosis, but that the majority acquire tuberculosis from other people rather than from animals. Only a careful system of meat and dairy inspection carried on for several years, comparing the vital statistics under the new and old régimes, can show just how important the danger from animal infection is. Still I think the animal is a source of danger, and that it is taking a step in the right direction to attempt to destroy this source.

The old Society for Promoting Agriculture, for which I at

one time had the pleasure of working, had an experiment farm for a couple of years at Mattapan, in Dorchester. I had charge of the farm, and also assisted with the microscopic work which was carried on in charge of Dr. Ernst at the bacteriological laboratory of the Harvard Medical School. At the farm there were always kept ten or a dozen tuberculous cows, and as soon as we got through with one cow I never had any trouble in finding another diseased one to take her place. Twenty-five or thirty cows were used in the experiments, which were carefully conducted. The pigs and calves were kept in a separate building from the cows, with quite an open space between, and the milk was carried to them. Each calf had its individual pail, which was scalded daily, and each had the milk from a certain cow. The pigs received the surplus milk from any number of cows, which was not required by the calves. The calves and pigs used for feeding experiments were, as a rule, killed when about six months old, and careful post-mortems made upon them. In most of the cases where tuberculosis existed in these animals the liver was the seat of the disease. In one instance a nodule was found in one of the kidneys of a calf, the other organs being apparently healthy, showing that the germ had almost escaped from the system through one of the ureters before it was caught.

In the consideration of a pure and healthful milk supply there are other diseases to be guarded against beside tuberculosis. Milk is a pretty good culture medium for various germs, and it may be a vehicle for conveying typhoid fever, cholera infantum, and similar maladies; therefore it is a very important matter to insure a proper milk supply, well worthy the consideration of every board of health, and to do it properly it seems to me that more can be done by means of State than by local legislation.

Dr. Alexander Burr. This subject of the inspection of milk farms seems to me to be a very important one. The danger from glanders, tuberculosis, or any other chronic contagious disease is going to increase rather than diminish, under the present condition; to receive anything like a healthy supply of milk for our tables it has got to be collected where there is the least possible source of contamination; for, allowing a few

germs to get in at the start, by the time we get it at our tables they have reproduced their kind away up into the millions; thus it seems to me that the stable is the first place where the greatest care should be taken, and to do this we have got to carry out the strictest sanitary and hygienic laws, not only in regard to the health of the individual animal, but in regard to the surroundings, the feeding of the animals, and the manner of milking them as well.

It does not follow because cows are not the victims of some contagious disease, that the milk coming from those cows is free from germs and suitable for food.

The non-pathogenic germs we care nothing about; we are constantly inhaling them, and introducing them into our system in milk, water, and other articles of food. It is the pathogenic germs which we must fear and guard against.

Tuberculosis is the one of all diseases that is creating the greatest interest, and in passing I want to say that I do not think that tuberculosis exists in Massachusetts to any greater per cent than in other States, in proportion to its population; neither do I think it exists to such an alarming extent as some of our veterinarians would have us believe, but that it does exist in the neighborhood of large cities, there is no doubt, and now is the time to fight it. There can be no doubt but that the tubercle bacillus is present in the milk from an animal with lesions in the mammary gland, and experiments have shown that it may be present where there were no lesions of the gland; and even if we should regard the milk coming from these last animals as being harmless, there still remains the dangers of infection of it from the outside, and this seems to me to be a very fertile source of danger, if we consider how easily, under the ordinary methods of milking and handling, anything in the air might drop into the milk pail.

Although glanders is not a bovine disease as far as we yet know, still how common it is to find a horse in an advanced stage of glanders in the same stable where milch cows are kept, and under these conditions is it not plausible to believe that the bacterium causing glanders might drop into the milk during the process of milking?

Tuberculous animals being present in a stable it follows

that the tubercle bacilli are being constantly thrown into the air of the stable. It is stated that cows do not expectorate, but to say that they do not cough up anything would not be correct, and even were it so, the expired air must contain the bacilli. The bacilli which escape in the human excrement go to places where they can do no harm; not so in the case of that from animals; that falls to the stable floor, is later thrown outside in a pile, and it finally contaminates the air of the stable. Thus it will be seen that milk coming from stables where contagious diseases are present, even though it does not contain the bacilli of any special disease when it leaves the mammary gland, may become infected from their presence in the air; and without going any further it is safe to say that the contagion of all contagious diseases is all over the stable where animals suffering from such diseases are kept, and hence the ready source for contaminating otherwise pure milk. And this brings me to the question of how long the bacilli will live. Sunlight and cold are detrimental to their growth, but they simply retard the growth, and are very slow; experiments have shown that tubercle bacilli may retain their virulent properties in sputum, which has been in a state of dryness for three years.

At one of the public institutions at Washington, I have been informed that they find considerable difficulty in keeping their herd of milch cows free from tuberculosis, and the officers of that institution account for it from the fact that these animals graze on the same grounds where human tuberculous patients roam, the bacilli retaining their virulence even though in a dry state.

Thus it seems to me if we expect to receive anything like a healthy supply of milk, our milk farms have got to receive a thorough inspection annually, semi-annually, or quarterly for all contagious diseases.

Mr. Smith. I would like to ask Dr. Durgin whether the Boston Board of Health has considered the question as to how far the boards of health can go in controlling the milk supply. I have heard the question asked by persons here in this room, among whom there has been some little discussion about the action taken by the Boston Board of Health, and whether boards of

health generally throughout the State would feel warranted in taking similar action. It is not a matter which I have considered at all, but I think there is some doubt, perhaps partly from a legal point of view, in the minds of those who have thought about the matter, whether boards of health generally would be warranted in passing rules as strong and vigorous as those which have been read here by Dr. Durgin.

DR. DURGIN. The statute law reads that boards of health shall make such regulations as they deem necessary for the protection of the public health. We consulted our law department before passing this regulation, and were told that it was right.

PROF. SEDGWICK. I think the point just made by Dr. Durgin is the very point that should have the most weight at present. He has said, I think, that in these matters it is as much a question of decency as of danger. I believe, however, that the feeding to young children or adults the partially decomposed food, even supposing it not to contain the germs of tuberculosis or typhoid fever, is ample warrant for the care which the board of health proposes to exercise over the milk supply; and with regard to the question raised by one gentleman, I will say further that it seems to me that it is the duty of the boards of health to lead the public as far as they possibly can in these matters. I know that it is not always politic, but I know that the American people like to be led when their leaders are competent, and I think that if the boards of health would amply explain the ground for their action, as the Boston Board of Health does in the preamble to these regulations, they would have no difficulty in finding a following. The whole point of the milk story is this: Milk is one of the most common articles of food; it is given especially to the young, and very largely to children under five years of age. It is usually drawn from the animals in stables which will not bear description in good society, from cows which often have flaking excrement all over their flanks, by milkmen who are anything but clean. It is drawn into milk pails which are seldom or never *thoroughly* cleaned, sent to the city over long journeys by rail, and at last arrives in the city, where it is still further delayed, and finally delivered to the consumer in a partially decomposed condition.

Children need normal milk. They do not get it from milkmen. As a rule, the milk is at least thirty-six hours old when it is delivered in Boston, and it is partially decomposed, — so far, indeed, that it is usually acid, whereas normal milk is not so. When you add to these facts the other fact that should be insisted upon, that it may contain the germs of disease, you have a story which any fair-minded citizen, it seems to me, must regard as deplorable. The wonder is that we have stood the thing as long as we have, and the wonder is that so many of us have survived as we have. But people will say, "I drink milk, I have drunk it from childhood, my grandfather drank it and lived to a good old age," and will argue that, therefore, there is no danger in it; but just bear in mind the numbers of people that have not survived; remember that we are only the picked few, after all, that have been able to stand this and a thousand other things; remember that if we, the picked few, are to be taken as the illustration of those who have been exposed to the dangers of the milk supply, it is exactly like taking the members of the Grand Army when they are out on parade and feeling of their muscles, and then saying, "Well, war is not such a bad thing after all; these men seem to be a pretty healthy lot; they are living to a good old age." It is exactly the same kind of logic.

So there are many sides to this question; but I repeat what I said before, that I am proud that the Boston Board of Health has had the courage to take the bit in its teeth and attack the large amount of filth in milk which is a source of great danger. I do not think that we need go beyond the statement that with this, and with the possibility of typhoid and scarlet fever germs, the whole makes up a question that must be faced until people shall realize that it will not do to pay several dollars a bottle for champagne for themselves, and a few cents a quart for dirty and perhaps dangerous milk for their babies.

The trouble begins in the stable; it grows in the transportation, and culminates after delivery, and I am glad to see that the subject is to be taken hold of as it should be by the Boston Board of Health.

Mr. Smith. I think that the boards of health everywhere will have a great deal of sympathy with the Boston Board of

Health in its efforts to purify and make safe the milk supply in Boston; but as a former speaker suggested, the remedy is very inadequate, if protective measures are confined to Boston. The largest part of the milk used by the citizens of Boston and of adjacent cities is produced on the farms back in the country, and there should be co-operation between all the boards of health in this part of the State in order to produce anything like a substantial result.

Now, if we eliminate from our discussion the prevention of tuberculosis, and consider merely the matter of cleanliness and the prevention of filth in milking the cows and taking the product to the market, it seems to me that we still have to deal with a very large and difficult question. No doubt the boards of health can do something to improve cow stables, to secure better ventilation and more cleanliness, — they can do something; but from what I have seen myself (and I was brought up on a farm, as probably a large number present were), I know that a large part of the filth which gets into the milk gets there in ways beyond the direct control of boards of health, for it gets in there by the careless behavior of the milkman. By the milkman I mean the man who milks the cow. (I don't know what the milkman who sells the milk does with it; only the milk inspectors know that.) The day has gone by when a pretty milkmaid went in clean white apron and with shining milk pail to milk the cow with the crumpled horn out among the buttercups of a dewy morning. Instead, some old fellow stumbles out of the house and to the barn, with the stump of a clay pipe in his mouth and wearing overalls and boots saturated and covered with the filth acquired by a winter's use. When he reaches the barn, he selects some recumbent cow, kicks her until she stands up, dripping and slimy, and, as he is a little late and the milk will have hardly time to cool before the man who carries it to the city will come along, he does not stop to clean up behind the cow, but sitting down on a stool, proceeds to gather the milk and whatever else may fall into a pail which perhaps is clean and perhaps is not. Of such refinements as washing the udder of the cow or wiping her flanks, he has never heard. If he has, it is only to scoff.

Then he strains the milk behind the cows. That is bad

enough, but it is not all the story. Every one knows that in straining the milk the strained becomes obstructed more or less with dirt and filth, and when the milk does not run fast enough he would be a rare milkman who hesitated to scrape away a place with his fingers, so that the milk may run more freely. Those who have seen certain fingers, as I have, know what that means.

If the people of Boston only knew how much filth they drink in their milk they would be frightened. I know one family who were pretty well alarmed by the discovery of a peculiar flavor in their milk; they could not make out what it was until finally, thinking the milk tasted a little like tobacco, they found out that the man who milked smoked a pipe while milking, and when the cow kicked or switched its tail to brush off a fly or something of that sort, his pipe frequently was upset and its contents knocked into the milk pail.

Now, while I say that we ought to approach this matter in all seriousness, and while we ought to remove every chance for contagious disease, to try to get better stables and better ventilation, and to make all the conditions clean and wholesome, I say that it is impossible to improve the condition of the milk that is carried in from towns about Boston unless we improve the *morals*, so to speak, of the milkman; unless every one who takes milk, every one who handles milk, the milkmen who carry it into Boston, all see to it that the milk is produced perfectly clean. Boards of health should co-operate to create a strong sentiment in this matter. The idea existing to some extent in the community that the present condition of things is harmless, must be reformed. Only then can we hope to have our milk the clean and wholesome article that it ought to be.

Mr. French. There is one thing I would like to ask Dr. Durgin, and that is, if, in drawing up those regulations, they have considered the height of the studding of the stable in which the animals are kept? It seems to me that nothing less than eight feet studding should be allowed where milch cows are kept for dairy purposes; for I have in mind stables with only six feet studding, but which, undoubtedly, provide a thousand feet of air space for each animal. In such instances, the exhalations and emanations rising from the animals and the

manure vaults must be far in excess of the quantity of pure air supply, and, upon reaching these low ceilings, are thrown down again, so that the animal has scarcely any chance at all to breathe pure air, which must, in my opinion, have the effect of breaking down the health of the animal. If I may be pardoned for referring to it, I hope that the subject of dry closets in schools, previously spoken of, may be given some attention and discussion by this association, as it is a matter which my board is investigating, and, as far as we are able to find, the dry closet is not regarded as the proper thing for introduction into our schools. I hope that this association will consider this and find it worth while to take some official stand on the question.

Dr. Durgin. I would say in answer to Mr. French's question about eight foot studding, that, in drawing up this regulation, we avoided much detail. We call, however, for the lighting and ventilation to be satisfactory to the Board of Health, and no stable will be approved until seen and found to be satisfactory. Eight feet in new work ought to be required, but it will be found necessary to accept compensating conditions in many of the old stables where the studding is a trifle under eight feet.

CHOLERA ASIATICA.

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VOL. II. AUGUST, 1892. No. 3.

QUARTERLY MEETING.

Gallop's Island, July 29, 1892.

Dr. Henry P. Walcott, Chairman of the State Board of Health, presided, and after dinner called the meeting to order. The records of the last meeting were read by the Secretary, Dr. Lemuel F. Woodward. After the transaction of the regular business of the Association, the Chairman announced as the topic for discussion, "Cholera and its Possible Extension to this Country this Season," and said: —

"It must be remembered that cholera, more than almost any other epidemic in this country, has justified the existence of public and municipal boards of health. Under the excitement occasioned by its earlier invasions, health boards were very generally organized, in this State at least. All the questions of municipal sanitation are distinctly involved in it when we attempt to ward it off, perhaps more than in any other epidemic that we have had. I think the question which will be prominently brought up this afternoon is a very important one, — what regulations and precautions the municipal boards of health are going to adopt in the presence of such an epidemic, and I am happy to state that the question will be considered by Dr. J. H. McCollom.

Cholera Asiatica.

Mr. President and Gentlemen: — In view of the fact that cholera has become epidemic in Saratoff, Russia, a city with a population of over 100,000, and also that a certain number of

cases have appeared in Paris, it seems eminently fit that the subject of our discussion to-day should be the causation of, and the best measures for the prevention of, the disease. Although cholera undoubtedly has been endemic in India for many centuries, the only accurate and reliable accounts of the disease date from the middle of the last century.

In 1768–71 Sonnerat described an epidemic in Pondicherry, the chief French settlement at that time in India, which destroyed 60,000 lives. From 1817 to 1830 there were several epidemics in India of greater or less severity, but the disease did not extend to Russia and Norway until 1830. During the year 1831 the disease made its appearance in Berlin, and from that city spread to London, Edinburgh, and Dublin, in the beginning of 1832. In July of that year the disease crossed the Atlantic Ocean and appeared in New York, and, shortly after, in Philadelphia and in Baltimore, extending as far south as New Orleans, and as far north as Montreal and Quebec. Cholera has invaded this country twice by way of Canada, twice by way of New Orleans, and twice through New York. The epidemic of 1884, in Europe, did not gain a foothold in this part of the country, probably owing to the efficient quarantine regulations. The greatest epidemic of cholera that has ever occurred in Boston was in 1849, when there were 707 cases, and 611 deaths, with a population of 136,881, giving a ratio of deaths to the 1,000 of the living of 4.46+. The next epidemic in this city was in 1854, when there were 218 deaths from this disease, a population of 160,490, giving a rate per 1,000 of 1.35+. In 1866 there was a slight outbreak of cholera in Boston that caused eleven deaths. In 1871 four deaths from cholera were reported, but since that time there is no record of a case having occurred in this city.

India is the home of cholera, and every epidemic of the disease can be either directly or indirectly traced to that country. The filthy habits of the natives, the immense caravans of pilgrims to the shrine of Mecca, the pollution of the water-supply, the impossibility of enforcing proper sanitary regulations, serve to keep alive the disease in India whence, when the conditions are favorable, it must extend to other and far distant lands. The course of cholera always follows the line of trade, and the

different avenues by which the disease enters any country can be explained in this way. In former years much was said regarding climatic influences as a cause of cholera, and while it is true that a high temperature has a marked effect in causing the spread of the disease, it is also true that atmospheric conditions can have no effect in originating it. As illustrating this point the history of two cholera infected ships that sailed from Havre a few years ago, one bound for New Orleans, the other for New York, is of interest. In the former city the arrival of the cholera ship caused an outbreak of a severe epidemic of the disease; in the latter city, although a few isolated cases could be traced to the infected ship, there was no epidemic.

In the report to the International Sanitary Conference in 1866, of a commission from that body, appear the following statements:—

"1. That the matter of cholera dejections being incontestably the principal receptacle of the morbific agent, it follows that everything which is contaminated by these dejections becomes also a receptacle from which the generative principle of cholera may be disengaged under the influence of favorable conditions; it follows, also, that the production of the cholera germ takes place very probably in the alimentary canal, to the exclusion, perhaps, of all other parts of the system.

"2. That in the open air the generative principle of cholera loses rapidly its morbific activity, and that such is the rule; but that, under certain peculiar conditions of confinement, this activity may be preserved for an undetermined period."

Although at that time the specific germ of cholera, the comma bacillus, had not been discovered, the conclusions reached by the commission are not materially different from those of more modern observers. The discovery of the comma bacillus, the undoubted cause of the train of symptoms known as cholera, has, however, placed our knowledge on a sure basis; what has heretofore been conjecture is now capable of positive and absolute demonstration.

Under suitable conditions of warmth and moisture this organism increases with remarkable rapidity. Milk is an exceedingly nutrient medium; this may explain the virulence of certain

outbreaks caused by contaminated milk. In dejecta sprinkled on moist linen or soil the bacilli multiply at an enormous rate.

It being granted that the chief, if not the only, avenue by which the germs of the disease can enter the body is the alimentary canal, it is evident that contaminated food, and more particularly a contaminated water-supply, are the sources of danger, and, therefore, to their purification must our attention be directed in stamping out an epidemic. The effect of a contaminated water-supply is very well shown in a chart in Prof. Koch's Report on Cholera in Calcutta. This chart shows that the disease was much more prevalent from 1865 to 1869, inclusive, when the water was taken from the Hoogley, directly opposite the city, than it was from 1870 to 1874, inclusive, when the water was taken from the river twenty miles above the city, where the chances of contamination are slight.

The history of a slight epidemic in Yport, a small fishing village near Havre, as given by M. Gilbert in the *Revue Scientifique*, is an apt illustration of the manner in which the disease may gain a foothold in any locality: A sailor had an attack of cholera at Cette; and on the day after his arrival at Yport, he washed his soiled clothing and hung it out to dry in front of his house, allowing the dirty water to run along the street. From this *nidus* the disease started, and there occurred forty-two cases, with eighteen deaths. M. Gilbert's conclusions as given by Dr. G. B. Shattuck in the "Boston Medical and Surgical Journal" of Feb. 19, 1885, page 178, are as follows: —

"1. That cholera was brought to Yport.

"2. That it was brought by insufficiently disinfected clothing, soiled by cholera dejecta.

"3. That, after this clothing was washed, it became the agent of severe and rapid contamination.

"4. That the cholera was propagated, by means of contagion, from house to house, without its being possible to attribute a single case to the transportation of the specific germ by the air.

"5. That the sanitary measures taken, although incomplete, inasmuch as it was not possible to separate the sick from the well, were sufficient to stamp out the epidemic.

"6. That the complete destruction of the cholera dejecta, and the disinfection of all effects soiled by them, seems to be sufficient to stamp out an epidemic of the disease when it has not attained too great proportions.

"7. That contagion by the air (the common acceptation of the term) appears to be an error; for at Yport three nuns and three physicians or students in medicine lived for a month under the most favorable conditions for taking the disease by this channel. They all escaped, with no further precautions than taking their meals at a distance from the cholera patients, and avoided the handling of moist and soiled clothing.

"8. The question of water has no bearing in this case, for the very good reason that the Yportais never drink any."

In regard to the last conclusion, it may be said, that although the residents in this town may not drink water, they probably eat salads that are moistened with infected water.

The epidemic of cholera in Toulon, in 1884, can, without doubt, be traced to clothing soiled by cholera dejecta. Dr. Lippertz, who accompanied Dr. Koch to Toulon, makes the following statement regarding the introduction of the disease into that city: "Close to the harbor was a public market, where fruit, vegetables, snails, and other Southern delicacies were sold. By the side of the market, gutter water of questionable clearness flowed. The market people, however, considered the water good enough not only for cleaning their stalls, but also for refreshing their thirsty goods." This is a good illustration of the way in which cholera may gain a foothold in a city or town.

In order to show what can be accomplished in preventing attacks of the disease in those who have the immediate care of the sick, the following account of the methods adopted in the hospitals of Chili during the cholera epidemic of 1886–87, as given in the Hon. Rollo Russell's book entitled "Epidemics, Plagues, and Fevers," is of the greatest importance: —

"A number of small hospitals were established in different localities of the town; each of the hospitals contained from fifty to sixty beds, and had a staff of six doctors, six students, and thirty attendants. All wore long aprons, reaching from

the chin to the feet, and caps. For washing the hands and face a solution of corrosive sublimate was exclusively used. In the dining-room all dishes before used were strongly heated by the flame of burning alcohol. The bread was sterilized by toasting. It is stated that no one of the staff who adhered rigidly to these precautions sickened. The convalescents before their discharge were bathed in the corrosive sublimate solution (1 per 1,000), and their clothing was washed in a similar disinfecting fluid. The floors of the hospitals were made of a kind of a pine parquet soaked in tar, and were washed daily with a solution of either copper sulphate or potassic permanganate (1 per 1,000). On emptying a ward, it was acted on by sulphurous acid gas for twenty-four hours."

During the epidemic of 1849, in Boston, the cholera hospital was situated on Fort Hill, and although there were many cases in the immediate vicinity, none of them could be traced to infection from the hospital, but they were caused by the unsanitary conditions of the dwellings, and the filthy habits of the tenants. No cases occurred in the houses on the hill which were occupied by the better class of residents. The foregoing statements have an important bearing on the location of hospitals in the event of an epidemic of cholera. It is also a significant fact that during this epidemic none of the physicians in attendance at the hospital had the disease, although it must be remembered that in 1849 the importance of antiseptics was not fully appreciated.

While the danger of an extension of the disease through the air, or by contagion, is very slight, it must not be supposed that efficient measures for stamping out the disease cannot be adopted. An eminent writer on hygiene says regarding cholera that it is always carried by filthy men to filthy places. It is therefore important that the most careful attention should be given to the abatements of all nuisance caused by defective drainage, stagnant waters, and that abomination known as the privy vault, a most prolific source of disease in our community. The paramount necessity of a careful supervision of the water-supply particularly in the case of wells cannot be too strongly emphasized. Large bodies of water are not easily contaminated, and, if contaminated, will purify themselves to a greater or less

extent. The conditions are very different in the case of wells. If the germs of disease gain entrance to a well they multiply to an indefinite degree. Hospitals in places easy of access must be established, for the cholera patient does not bear transportation well. Instruction of the community at large regarding the necessity of disinfection of the cholera stools and of the soiled linen is one of the most important adjuvants in dealing with an epidemic of this disease. But instruction regarding disinfection is not enough, there must be the most rigid regulations concerning it.

The International Committee of experts at the Sanitary Conference held in Rome in June, 1885, recommended the following methods of disinfection : —

"1. Steam at 212° F. 2. Carbolic acid and chloride of lime. 3. Aeration. Carbolic acid and chloride of lime to be used in aqueous solutions. Weak solutions: carbolic acid, 2 per cent; chloride of lime, 1 per cent. Strong solutions: carbolic acid, 5 per cent; chloride of lime, 4 per cent."

"1. For the disinfection of the person weak solutions should be employed.

"2. For clothing, bedding, etc., (*a*) destruction; (*b*) steam passed through the articles for one hour; (*c*) boiling for thirty minutes; (*d*) immersion for twenty-four hours in one of the weak solutions; (*e*) aeration for three or four weeks, but only in case the other means recommended are inapplicable. Articles of leather, such as trunks, boots, etc., should be either destroyed or washed several times with one of the weak disinfecting solutions.

"3. Vomited matter and the dejections of the sick should be mixed with one of the strong disinfecting solutions, in quantity equal to the amount of material to be disinfected. Linen, clothing, etc., which cannot be immediately steamed as described, should be at once plunged into one of the strong disinfecting solutions and left for four hours.

"4. The dead should be enveloped in a sheet saturated with one of the strong disinfecting solutions, without previous washing, and at once placed in a coffin.

"5. Steam under pressure is the only reliable disinfectant of rags.

"6. When cholera occurs on a vessel at sea, the place in the vessel where the case occurs should be disinfected. The bilge-water should be pumped out and replaced by sea-water at least twice at each disinfection of the vessel. The closets should be well watered with one of the strong solutions at least twice a day.

"7. If the drinking-water is open to suspicion, it should be boiled before it is used, and the boiling should be repeated, if it is not used within twenty-four hours. All suspected food should be destroyed.

"8. Hospitals should be disinfected by washing the floors and walls with one of the weak solutions, by a subsequent free ventilation and cleansing, and finally by repainting. The wards to be disinfected should be isolated from those in use. Latrines to be disinfected at least twice a day with the strong solutions, in quantity at least equal to the amount of dejecta received since the last disinfection.

"9. The clothing worn by physicians and attendants should remain in the hospital, and should be regularly disinfected. Physicians and attendants should use the weak solution for washing their hands, etc."

As the period of incubation of cholera is at the outside only four days, it is evident that an efficient sea quarantine will prevent the introduction of the disease into this country. It is necessary, however, in enforcing a quarantine that not only the well-marked cases, but also the ill-defined, doubtful ones should be isolated. A land quarantine or cordon is not possible in a country like ours, and when it has been attempted, has been of little or no avail. While speaking of quarantine, a few words regarding the admission of rags from infected districts may not be amiss. Prof. Koch's experiments prove that the comma bacillus, under favorable conditions, may retain its vitality for months, and it is therefore reasonable to suppose that a mass of rags, soiled by the dejections of cholera patients, may form a *nidus* for an extensive outbreak of the disease.

Although the danger from infected rags in bale may be comparatively slight, it seems to me that the subject is one that demands careful thought and a free and extended discussion by the members of this society.

In conclusion, permit me to offer for discussion the following suggestions as to the method to be adopted for preventing an epidemic of cholera in this country : —

1. An efficient sea quarantine.

2. Isolation of all suspected cases occurring in cities or towns.

3. Establishment of hospitals for the treatment of the disease.

4. The most careful disinfection of the dejecta of cholera patients, and of all soiled clothing.

5. A careful attention to the sanitary conditions of cities and towns.

6. The most rigid supervision of the water-supply, particularly in the case of wells.

The Chairman. It is known to you all that any attention which will be given to this matter by the general government will be given through the medium of the Treasury Department; and it is fortunate that Dr. Fairfax Irwin, of the Marine Hospital Service, is here, and it is now my pleasure to present him to you.

Remarks of Dr. Fairfax Irwin.

Dr. Durgin has kindly asked me to make a few remarks to-day on the subject of cholera, more especially as to its present whereabouts, and the special danger, if any, as to its appearance on our shores. With regard to the latter, I think the subject may be dismissed with few words, for, it seems to me, the danger of the arrival of cholera is about as great now, under similar conditions, as it ever was, *but no more so.*

While the increased facilities for travel, both by land and sea, would favor the extension of epidemic diseases, I believe the great sanitary advances that have been made for its control will neutralize this untoward effect of commerce. In any case, it behooves us to be always expecting danger and thus be always on guard.

As to the present location of cholera in epidemic form, it has been officially stated to prevail in the Caucasus, in Eastern European Russia, in Persia, in Calcutta, and on the Western littorae of the Red Sea. Let us glance at these localities for a moment. In the Caucasus the extension westward of the disease would be by ports of the Caspian and Black Seas, and it has in fact appeared at both. June 29th it was declared epidemic at Baku (Caucasus), a port on the Caspian Sea. Under date of June 27th, the American consul at St. Petersburg states that there was no doubt of its presence in Astrakhan, the capital of the most southeast province of Russia. Under date of July 18th, the vice-consul at Odessa cables that cholera has appeared at Rostoff. This place is a town of about ten thousand inhabitants, almost due west from Astrakhan, and distant about four hundred and fifty miles. This is significant, because it was confidently expected that if the disease extended from Astrakhan it would be along the line of the Volga, and in the direction of Nijni Novgorod, where the great annual fair of Russia takes place. It is northwest of Astrakhan about nine hundred miles. Instead then of following the course of the Volga at first, it has gone west by the shorter route to Rostoff, on the river Don, twenty-two miles above the Sea of Azor, and, as a consequence, the Black Sea. This, it would seem, has been followed by an extension up the Volga to Nijni Novgorod, as would be expected, for the papers of the 26th of July state that there were twenty-six cases of cholera in this city, perhaps one of the worst cities in Europe for an epidemic at this season of the year. The number of cases in Astrakhan were given as 2,012, with a mortality of 1,302 for July 21, 22, and 23. Also, it is said to now be present at Viatka, about three hundred miles north of Nijki.

Now, just a word as to our Russians; that is, those who come to Boston. They come almost entirely from the provinces of Kovno and Wilna, bordering on the Baltic, and distant about eighteen hundred miles from the infected districts. These people usually cross the frontier into Prussia, and take ship at Hamburg. Cholera is epidemic in Arabia and on the western border of the Red Sea. This brings it into easy communication, by way of the Isthmus of Suez, with the Mediterranean Sea and its numerous ports.

In conclusion, I think proper to say that, for the present, the surest step we can take in the direction of safety is to detain all immigrants from Russia for cleansing, and for the disinfection of their baggage especially, — this baggage being the most dangerous thing we have to handle. The cases of so-called cholerine in Paris have, up to date, been officially declared to be cholera nostra, and there is every reason to believe this is true.

July 28th, the evening dispatches state that cholera has appeared in Warsaw and points in Poland.

The Surgeon-General has prohibited the entrance of rags from France.

The CHAIRMAN. Dr. Samuel W. Abbott, Secretary of the State Board of Health, will now address you.

REMARKS OF DR. SAMUEL W. ABBOTT.

Mr. Chairman and Gentlemen: — The remarks I have to make will be principally upon one or two points, which are suggested partially by a statement that appeared in one of the public prints during the past week, as to the possibility of starting Asiatic cholera *de novo* in this country, as for instance from such an epidemic as has been reported at Salisbury Beach. I do not see how it is possible that such a thing could take place, unless some ship from a foreign port had been stranded upon Salisbury Beach and communicated the disease there. It is certain that no one of the five epidemics of cholera which have occurred in this country, in 1832, 1849, 1854, 1866, and 1873, began in that way; but every one of them was introduced by immigrants from some infected foreign country, not necessarily from an infected port of a foreign country. In one or two of those epidemics the people who introduced the disease came from ports which were known to be non-infected, but they were known to have come to those ports overland from infected countries. In the epidemic of 1854 over one thousand persons died on the ocean, of cholera, on board of twenty-eight vessels which arrived at New York City; on each one of them more or less died during the passage. It is not a very difficult thing to start an epidemic by infected persons arriving here, and passing into the different ports of the country, if there is not an

efficient quarantine. It is easy to trace the origin of each of the five epidemics to which I have referred, as the vessels are all known, and their names and the places whence they departed and where they arrived are all recorded.

In 1832 the "Carricks" arrived at Quebec on June 3d, preceded by three or four other ships, the "Constantia," the "Robert," and the "Elizabeth," from Limerick, Dublin, and other Irish ports. One of them had fifty-nine deaths from cholera aboard during the passage, and the epidemic which followed at Quebec and spread through Montreal came immediately after the arrival of those ships.

In 1849, or late in 1848, there arrived at New York the ship "New York," and at New Orleans the "Swanton," both leaving foreign ports about the same time; I think both sailed from Havre. One arrived at New York on December 2d, and the other at New Orleans on December 11th, spreading the disease in New York City and through New Orleans, up through the Mississippi Valley as far as St. Louis.

I have already mentioned twenty-eight vessels which arrived during the epidemic of 1854, in which 1,141 persons perished of cholera during the voyage.

In 1866 the first cholera ship arrived at New York, and forty-two cases were admitted to the hospital in New York City at that time. The same story is true of the epidemic of 1873.

All of these epidemics affected Massachusetts more or less, except that of 1873. Dr. McCollom stated that there were two or three deaths that year, but there is doubt whether they were from Asiatic cholera or not. So we may practically say that cholera has not been in Massachusetts since 1866, or during a period of twenty-six years; and few of us have ever seen a case of Asiatic cholera; I never have, and the majority of us certainly have not.

Another point is that cholera does not come in cargoes. I think that has been stated and laid down as a proposition that has been proven in Dr. McClellan's very elaborate work on the cholera in 1873, one of the best works on that disease ever published in this country.* He says it is not likely to come in

* "It has not yet been demonstrated that merchandise, in contradistinction to passengers' luggage, is ever the medium of conveying the cholera poison across the Atlantic." — *The Cholera Epidemic of 1873 in the United States*, p. 9. Washington, D. C., 1875.

cargoes, but comes with people and their personal effects, with their baggage. The cholera germ comes across in their baggage, and when their baggage is unpacked people are exposed to it; and many people who have crossed the Atlantic free from cholera have died from it after their goods were unpacked on this side.

Another negative fact may be mentioned: With regard to the question of the spreading of cholera by means of pilgrimages, the passing of people from one country to another, there is no place where the transportation of persons is more easy than it is in the United States at the present time. During the war large bodies of troops were constantly moving from place to place, and were crowded together under the best conditions for the spread of cholera, and although three quarters of a million men were in the field on the average during those four years, not a single case of Asiatic cholera was reported; and yet after the war ended it broke out, because it was brought here by people from abroad.

Now, in relation to water-supply. There is a point which Dr. McCollom alluded to incidentally which I will enlarge upon a little. The epidemic of 1849, which was the largest one, producing the greatest number of deaths in Massachusetts and in Boston, and which prevailed considerably throughout the State, occurred nine or ten months after the introduction of Cochituate water into Boston, giving the city a pure water-supply. Boston was supplied before by old wells, which had been situated among cesspools and vaults for two centuries. Now the cases of cholera occurred in that part of the city which had not been supplied with Cochituate water, — in Sea Street, at Fort Hill, and the North End. There was a map published showing the exact location of each case, and there were none in the better parts of the city which were supplied with Cochituate water; and we may presume they were in those parts of the city not supplied at all. This accords with what is true in the East where the cholera has prevailed, in India, where they are accustomed to bathe in the tanks at times which are used for domestic supply of water.

Mr. George F. Babbitt. Do you mean to say there is no danger from cargoes?

Dr. Abbott. I would not say none whatever. it cannot be

put as squarely as that; but no cases of cholera have been known to have been imported into this country that have not been traced directly to people themselves and their effects. Even the cases in 1873, found out in Minnesota and Kentucky, developed after their trunks had been unpacked, and they took the cholera and died of it. I do not think it could be laid down that a case could not be taken from a cargo, for the steerage passengers might have close access to the cargo, but such cases have not been shown in the history of epidemics affecting this country.

Remarks of Dr. H. Lincoln Chase.

In the short time I have had to consider the subject of cholera and its possible extension to this country, I have been asking myself what would be the most important duties of a local health officer in the event of the discovery of it in this part of the country. As to the possibility of its coming to this country there can be no question. On the first reliable information of the presence of cholera in Boston I should issue to every house in Brookline a circular practically identical with that prepared by the Massachusetts State Board of Health a few years ago, giving full directions for the guidance of all concerned in preventing its spread. That circular I presume you are all familiar with, and its contents, it seems to me, nearly cover the ground. One reason for this step would be to make the entire population of the town comprehend the rules and regulations, and avoid the conflicts resulting from ignorance of the means necessary to carry them out.

The public water service would be inspected and kept under supervision, and the few residents supplied from Jamaica Pond and from wells would be obliged to take from the public water-supply. It will then be almost impossible for any one to pollute the water, even wantonly. The infection of the water-supply being made impossible, and the whole town having been put in as thorough a sanitary condition as possible in all other respects, little more could be done, until cases should be reported to the board, when careful investigation would be promptly made, and suitable arrangements made for home care, or in a temporary hospital. My hospital would be very centrally located, as chol-

era patients can endure very little transportation, and would have facilities for the destruction of all excreta by fire, and disinfection by steam of all articles of value exposed to contagion. I merely present this outline to invite your suggestions.

The CHAIRMAN. Dr. Sawyer, of Gardner, has promised to say a few words.

REMARKS OF DR. E. A. SAWYER.

The discussion has been so general that the remarks I shall make will be very short. To take one part of the topic and touch upon that particularly, "The invasion of this city by cholera," brings to mind a little article I saw in a medical journal reprinted from the London *Spectator*, saying that in England they did not have any fear of any possible invasion of cholera there, and from that I conclude that we need not have any fear of an invasion of it here. If that is a logical conclusion, perhaps it would be also as logical to take the latter part of their argument, which was that they advised the Health Board and local officers to take all the necessary precautions and the strictest measures to prevent any such invasion, saying that everything of that kind which would prevent an invasion of cholera would be for the sanitary benefit of the public health; and so if one conclusion is good for this country, the other would apply here just as well.

Theoretically, the invasion of cholera is to be looked for from three sources, — from the air we breathe, the liquid that we drink, and the infection of clothing and other articles of that nature; so that it seems that if we know from what source the danger comes, we can be well prepared to guard against it. As has been said by Dr. McCollom, cholera follows the line of trade and the course of traffic. It would therefore devolve upon the health officers in maritime localities to keep informed. The local boards in our country towns need not necessarily be alarmed at any possible approach of cholera to our country this present fall.

It is also said that intemperate persons are particularly predisposed to it. I mention that fact, because I do not want any of those who this afternoon have partaken of this beverage that has been given to us so freely to be unnecessarily alarmed.

It is only tonic beer, I am told, and was given us purely for medicinal purposes.

The CHAIRMAN. I hope the Association will have the pleasure of hearing something from a friend who is not altogether a stranger to this part of the country, though his residence is in a different portion of it. I present to you Dr. George H. Rohe, Superintendent of the Maryland Hospital for the Insane, at Baltimore, who for many years was a resident of this city.

REMARKS OF DR. GEORGE H. ROHE.

Mr. President: — As a theoretical, and perhaps I may also say somewhat practical, sanitarian, I have been very much interested in the discussion here this afternoon.

Looking back over the history of the previous invasions of cholera, which is the only guide we have with reference to any possible future visitation, we find that all the epidemics which have reached this country have come from that part of Europe where it is now so prevalent. The line of march of the disease is the line of emigration from that part of Europe. Our quarantine is unquestionably more efficient now than when cholera was here before, and will be more effective still, because the means of diagnosis of early cases are more thorough and trustworthy than they were then. Heretofore the disease got into this country before it was known that it was cholera. It was known, for example, that something which is now called cholerine or cholera nostras in France, was appearing in the seaports of the country, in New York, Boston, and Halifax; and after a while, after several hundred people had died from the disease, it would appear that it was genuine Asiatic cholera. At present we are in possession of means of definitely establishing that, without waiting until a considerable number, supposed to have cholerine only, have died.

The merits of Koch's discovery lies in this, — not so much that he has given us the means of destroying the infection as of recognizing the infection at an early period. I believe that the Marine Hospital service can render, and I am informed that it will render, this service to such local boards of health as request it; that experts would make the diagnosis, that the services of an expert could be obtained from the government to

establish definitely whether cases of disease which resembled cholera were actually cholera or something else. It seems to me rather a suspicious circumstance that, with the means of settling definitely what cholera is, there should be so much doubt about the disease which is prevalent near Paris.

I fancy that the measures which will be taken by all parts of the community in this country, and in Canada as well, will be sufficient to prevent the introduction of the disease, and to prevent its getting beyond the quarantine station, provided there is an outbreak on board a ship before landing. But cases have broken out in this country, imported from abroad, where the persons took the disease after they came here, from infected material which they brought with them, as has been stated. In view of what might occur, it would seem wise that the local boards of health everywhere should be prepared; that the people in the interior of the country as well as at the seaports should get their houses in order; that health authorities, State and local, should see to it that the conditions favorable to the development or spread of the disease should be at a minimum. The measures which have been laid down so precisely by Dr. McCollom in his paper seem to cover the question entirely. The establishment of small hospitals in different parts of the community especially commends itself to me as one of the wisest arrangements that could be adopted.

The CHAIRMAN. We are always confronted with two questions: In the first place, what ought we to do in the case of an outbreak of an epidemic? And next, what can we do, and what does public opinion justify us in doing?

The first question is a medical one, to be settled by medical men. But with regard to the second question we must seek the best public opinion; and with regard to a very important side of this question there is no one better qualified to speak upon it than a gentleman who is present, who is not a physician, and I will ask Mr. Louis D. Brandeis, of Boston, to say a few words.

REMARKS OF LOUIS D. BRANDEIS, ESQ.

I owe my invitation to be present to the circumstance that, during the years 1884, 1885, and 1886, I was engaged in an

investigation of the supposed danger attending the importation of old rags from Europe and parts of Asia. The Federal Government and some local boards of health, in their desire to protect this country from cholera, which was then epidemic in Asia and Southern Europe, had enacted regulations which either totally prohibited the importation of such rags, or required them to be disinfected before they could be entered at this port. My clients, paper manufacturers, and importers of rags, believing that these regulations were not justified by the past experience of the world or by the recent scientific research into the nature and origin of cholera, requested me to aid them in examining the question, and later in presenting the result of our investigation to the health authorities, with a view to securing a modification of the then existing regulations. Our inquiries led us to investigate both the history of the rag importing trade and the most recent scientific researches.

The history of the trade taught us this: The importation of old rags into this country from Asia and Europe had been carried on to a greater or less extent since 1832. The importations had, with a few exceptions, increased from year to year. About 60,000 tons are now imported annually. Of these nearly one half come directly to Boston.

In spite of these large importations, there had never been traced to foreign old rags a single case of infectious disease, either cholera or any other. As has been stated to you here to-day, cholera has been introduced into this country by men with their filthy baggage and their filthy clothes, but in no instance during all those years has there come a single case of cholera or any other infectious disease that could in any way be ascribed to the importation of rags. Boston has been free from any cholera since 1871, yet more foreign rags enter here than at any port of the Union; and Massachusetts is the chief paper manufacturing State in the Union. Indeed one third of all the rag paper consumed in the country is made in this State. This immunity from infection through old rags continued through those many years, although previous to 1884 no regulation whatsoever, concerning the importation of old rags, had been adopted. There had not been previously either any pro-

hibition of their entry or requirement of disinfection. The history of our epidemics fails to show that even domestic rags — that is, rags gathered in this country — have ever carried cholera: but such domestic rags have, in a few instances, been the cause of transmitting small-pox. Our investigation into Dr. Koch's then recent discoveries concerning the cholera bacillus explained and confirmed all the other evidence showing that foreign old rags had never in fact been carriers of disease to America. The explanation is this: As was stated by Dr. McCollom, the cholera bacillus, in ordinary conditions of light and air, is very short-lived; it loses its activity quickly. It can, as was stated, under certain conditions, — what the scientists call "favorable conditions," — retain its activity for a long time. Those are conditions of moisture. But it is commercially impossible that a condition of moisture should exist in the imported old rags. No rags would be merchantable if they had been imported moist, because so long a time, often many months, must elapse between their gathering and packing in Europe and their use in the American mills, that if they were not perfectly dry when packed, they would rot and become worthless. Let me state briefly the manner in which these rags are gathered, packed, and brought to this country.

The ordinary person, thinking of rags, pictures to himself a filthy foreigner, prowling about amidst ash barrels in foul alleys, picking up such dirty clothes and rags as have been thrown away, and finally carrying them in his sack to some dirty hovel where he lives. This is the idea we ordinarily associate with rags, — the idea we form from the American rag-picker, — and we assume that amidst the pauper labor of Europe and Asia the conditions must be much worse. In fact, the business there is a very different one. It is carried on there by great merchants, who have large dusting rooms, sunny drying rooms, well lighted sorting rooms, packing rooms, and warehouses devoted exclusively to this trade. There are, of course, like here, rag-gatherers who go about the streets, not those prowling among ash barrels, but generally passing from house to house; because the economy of the people is such that the rags are seldom thrown away; they are carefully husbanded until they can be sold, and are often washed by the

owners so as to bring a higher price. Those rags are gathered in extensive sheds. There the rags must be dusted or carefully cleaned; then they are exposed to the sun and dried. After that they are sorted. This is a long and very careful process, because the value of the rags as a commercial article depends upon the care with which they have been sorted, the various kinds of rags having different prices in the market, the mixture of the rags making them less valuable and even useless in trade. There is first a careful separation of the waste — like leather or stays — from the rags; then a separation of the woollen from the cotton and linen rags, because the woollen rag has no use in paper manufacture, and a woollen rag among cotton rags might spoil a good deal of paper. The linen rags are separated from the cotton, because the linen are far more valuable. And finally the cotton rags are divided into the blue, red, white, and so on, and of each of these there are different grades, according to the quality or condition of the rag. Thus, there may be thirty-five or forty different kinds and grades from the same rag-house.

Such is the importance of the careful drying and sorting, that according to the reputation of the rag-house, the price of the same grade of rags will vary in the market, and the distinctions are so carefully made that the variations range as low as $\frac{1}{16}$ cent per pound. This work is, therefore, thoroughly done, and in very light places. It is done mostly in large rooms, by girls, whose work is carefully supervised. After this cleaning, drying, and sorting, the rags are tightly compressed in bales — usually five to ten to the ton.

As the grades of rags are so numerous, and as the rags are sold in large quantities, rags of any particular grade must usually lie quite a long time in the warehouse, until there are gathered sufficient quantities of that grade to make it possible to sell and export them.

It follows, therefore, that while it is conceivable, as has been suggested, that the cholera bacillus could live, under favorable conditions, for a few months, the conditions of the foreign rag trade are such that no cholera bacillus would ever be brought here in a bale of rags. Those favorable conditions which the scientists say are essential to the maintenance of the germ

never do occur in fact. If any cholera bacilli were in the rags when gathered, they must lose their activity long before they get to the point of baling, and even after baling there is a long period of time before they can reach this country and be opened at the mills here.

Although every one is interested in preventing the introduction of cholera, no one is so much interested as the paper manufacturer himself. The bales of rags are first opened in his mill; there they are first sorted, the work being done usually by a large number of young women; there they are cut and distributed; all this is done on his premises, where he and the people whom he employs are carrying on the business and spending their lives. It is obvioius that any fear on the part of the operatives would result in closing the mill and in most serious damage to the paper manufacturers themselves. It was, therefore, of more anxious concern to our clients than it could have been to any other class in the community, unless it was the board of health, that every precaution should be observed to avert danger. It was only after very careful consideration of the question, and after reaching the conviction that no danger existed, that they requested the government and the various boards of health to investigate the question, with a view to modifying the then existing regulations. That investigation was made in several places, but nowhere so thoroughly as here in Boston. The inquiry was carried on here under circumstances which were sure to bring to the attention of the Committee on Health all possible relevant evidence — for there were remonstrants as well as petitioners.

These hearings began in Boston on March 16th, 1886, and were continued, one or two a week, until June 15th, 1886. The report of the testimony covers over 1,200 pages. Thirty-three witnesses were examined, a large number of them eminent sanitarians and experts. Full reports showing the experience of other nations were introduced. For ten weeks the committee held its report under advisement. Finally, on August 30th, 1886, they reported that the alarm which had been spread in the community in regard to danger from foreign old rags was without foundation, and that there was practically no danger to be apprehended from such source; that the commercial

experience of the world up to that time had been such as to lead them to believe there was no ground for apprehension, and that this experience had been explained and confirmed by the recent scientific investigations; that therefore the requirement of disinfection imposed upon the importers of rags — and that of course means upon the community — was an unjustifiable burden. In consequence of this report the regulations were changed, and there has been no ground to regret the change.

The commercial importance of the question is obvious when one remembers that the importations of old rags into this port last year were 53,000,000 pounds of rags, that is, over 26,000 tons; that of all the rags required for American paper making, about 60 per cent now come from abroad. Any restriction upon their importation must consequently result in a very considerable embarrassment and disturbance of trade.

The Treasury Department, as has been stated, has recently prohibited the introduction of rags from France, although in France no Asiatic cholera exists; but I believe that this regulation will be rescinded upon full investigation of the question — as were its predecessors, six years ago.

Through the summer and fall of 1884, there came a long series of regulations from the Treasury Department at Washington, relating to the importation of rags. First they were prohibited; then allowed from certain ports; then required to be disinfected; but upon our calling the attention of the department to the facts above stated, all the regulations were rescinded, and the matter was left to the local boards of health. I have already stated the disposition which our Board then made of the subject.

It seems to me that as this question of the supposed infection from foreign ports is mooted again, it is important to look back to the experience of a few years ago and see whether there is anything in the experience of the world, in sanitation or in scientific research, which would justify the reversal of the conclusion reached then, and which was arrived at after a most deliberate investigation of the subject, occupying nearly two years.

The Chairman. We will now hear a few words from Dr. Cogswell, the Port Physician.

Remarks of Dr. C. H. Cogswell.

The subject has been pretty nearly gone over by the previous speakers, as to its commercial aspect and the present location of the disease. From what has been said, I think that possibly, as Dr. McCollom suggested, we are dependent upon sea quarantine to keep the disease from this country. Possibly you might be interested to hear a short account of what precautions we take here to prevent the entrance of cholera. In the first place, as has been said, there is very little to fear from any cargo. I was glad to hear that fact brought out strongly. I have here a copy of a circular issued by Supervising-Surgeon General Wyman, of the U. S. Marine Hospital Service, in which he says: —

"In view of the threatened further spread of the disease, and because of the danger which attaches to rags, furs, wool, hides, etc., which may have been gathered in the infected districts, and to articles of personal wear therefrom, it is hereby ordered that no vessel having rags, furs, skins, hair, feathers, boxed or baled clothing or bedding, or any similar article liable to convey infection, hailing from any port in the districts aforesaid, and no vessel from any port carrying the above-mentioned merchandise or immigrants from the present infected districts, or from districts that shall hereafter be officially declared infected, will be allowed entry to any port in the United States unless provided with either a consular certificate, or a certificate from a medical officer of the Marine Hospital Service, or State or local quarantine officer of the United States, to the effect that the vessel, cargo, personal effects, etc., have been disinfected in accordance with the methods herewith prescribed."

Now, in the nine years that I have been connected with the Quarantine Department, I have never known any vessel or cargo coming direct to this port from any port supposed to be infected; I have never been able to find any vessel that has arrived from such ports. Now we may get cargoes of hair, hides, rags, or wool from an infected district by means of transshipment. Under the present rules and regulations we have no means of knowing from what place cargoes come, unless they come on what is called a through bill of lading, which they seldom do. A great many cargoes go to Hull, London, or Liverpool, and there are transshipped to ports in the

United States. They may lie there in those British ports from a month to a year before they are sent to this country, then they come with a bill of lading from London, Liverpool, or Hull, and we have no means of determining from what ports they originally came. It is fortunate that there is not much danger of cholera being brought to this country by infected cargoes. I think, though, it is our duty to try to secure the passage of some law or regulation which will compel the shipper to forward with each consignment an affidavit stating the country and district in which the rags, hides, etc., were originally collected.

The greatest danger comes from the immigrant and his baggage, as has already been said. Excepting Russia, we have almost no immigrants coming from any country infected with cholera. We have very few immigrants coming to Boston except from Russia, Germany, Austria, Scandinavia, and the British Isles: these compose the bulk of our immigration. At present all immigrants from the southeastern portion of Russia are stopped at quarantine, and their personal effects and baggage disinfected by steam heat under pressure, the immigrants are given a thorough bath and scrubbing, and then allowed to proceed. In all the years that I have been here no vessel has arrived which was suspected of having cholera on board. Possibly now that cholera is epidemic in Europe, we may be a little more suspicious and more rigid in our examination than we should be under ordinary circumstances. If we should find that there had been a death from cholera on board any vessel which arrived at quarantine, or there had been any suspicious case of sickness resembling cholera, we would stop the ship here, and go through the same proceeding with the entire list of passengers and baggage that we do now with the Russians and their baggage.

The Chairman. This subject is open for general discussion, and I hope the opportunity will be taken advantage of by anybody who has a question to ask or a statement to make.

Remarks of Dr. J. A. Gage.

I will say a word as to the benefits to be derived from a visitation of cholera, though you may think that is a singular way

of presenting the matter. The idea was suggested to me by a remark made by a legal gentleman, who was endeavoring some years ago to carry out some rules in regard to cleanliness. He said if there was no fear of cholera he could not do anything with the people; but the moment he said "Cholera!" he could make them do anything he wanted to, to enable the local boards to improve the sanitary condition of the city or town. If it has this effect it may not be without some small gain.

The CHAIRMAN. What does Dr. Cutler propose to do in Waltham?

DR. E. R. CUTLER. We have been abundantly informed, and we shall do just as you do.

A vote was passed, thanking the city of Boston for its characteristic hospitality, after which the meeting adjourned.

THE DISPOSAL OF GARBAGE.

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Massachusetts Association of Boards of Health.

Organized 1890.

[This Association as a body is not responsible for statements or opinions of any of its members.]

VOL. II. NOVEMBER, 1892. No. 4

QUARTERLY MEETING.

Lynn, Oct. 20, 1892.

The Massachusetts Association of Boards of Health met at the Oxford Club House, Washington Square, Lynn, on Thursday October 20th, 1892. Dr. H. P. Walcott called the meeting to order shortly after 2 P. M. In the absence of the Secretary of the Association, Dr. J. H. McCollom was elected secretary *pro tem.* The records of the last meeting were then read, and there being no objection, they were approved.

The chairman then read a list of names of gentlemen who had been recommended to the Association by the executive committee for membership, and they were duly elected.

After a few other items of business, a paper was read by Mr. W. F. Morse on the "Engle Process for Cremating Garbage."

THE DESTRUCTION OF TOWN WASTE BY FIRE.

By W. F. Morse, New York City.

When in April I had the honor to prepare a paper for presentation before this society, I had fully expected to be present to read the paper in person, and to answer questions which might have thrown any light upon the subject of "Garbage Collection" and its "Disposal by Cremation" which was then the subject under discussion. But circumstances rendered it impossible for me to be present, and in the absence of information, supplemental in character to that contained in the paper contribu-

ted, and which could best be obtained by questions and answers, the subject received but little discussion and was left over for future consideration. Since the appearance of an epidemic upon our coasts, and the strong probability, reasoning from similar conditions in other countries in times past, that this plague might again appear with the warmth of the coming spring and prevail with the heat of the summer, there has been a renewed interest in the various methods of caring for the waste and worthless products of cities and towns.

None of the municipal problems, which the crowded life of our communities brings up are more perplexing, annoying and vexations than is this, nor is there any which more imperatively demands a speedy, safe, and unobjectionable solution. Such a solution appears to have been found by the adoption of the process of cremation: meaning the total destruction by fire of all the waste that can be affected by heat, and the utilization of the products of this combustion for economical purposes.

It is not the present purpose to discuss the question of the value of the waste of cities as food for swine or cattle. This is a practical matter involving financial questions of some moment to each place and city where the household offal has been so applied, and the sanitary aspect of this question has been ably treated by the State Board of Health in the publication of its papers upon "Trichinosis" and its appearance in swine fed upon the household offal of the city of Boston. Whether or not such use of household waste is a proceeding entirely sanitary — whether the swine fattened upon such food is in an entirely satisfactory condition to come upon the tables of the people, and whether the risk of poisoning or contaminating the milk supply of any place, where city garbage is taken away by the farmer ostensibly for the purpose of being fed to swine, and secretly fed to milch cattle — all these questions are subjects upon which the members of the association are better informed than the writer.

Without describing the other ways commonly in use for the destruction of waste of cities, all of which are only too familiar, it may be at once assumed in the case of a large majority of cities and places in this State, that the present way of caring for the waste from households, shops, stores, market-houses, the refuse from manufacturies, the bodies of smaller animals, and the general miscellaneous refuse and waste which a city or town must produce, has been and is now unsanitary and unsatisfac-

tory, is in many cases offensive, in some dangerous, and, as a whole can be improved, by the use of some better method or system.

In presenting the claims of "Destruction by Fire" of this mass of worthless waste, it is the intention to deal only with such practical facts as have accumulated in the writer's experience during a period of four years which has been spent in designing, constructing, and observing the operation of various styles of garbage cremating furnaces.

The cremation of garbage is not an exact science; no one can accurately say from experience in one place, what precisely will be the results obtained by identical means when used in another place; nor can any one predict what will be the amount, character, or class of waste which a city will send to a cremating furnace to be destroyed. But, by comparison of places where garbage has been destroyed by fire for some years, and by observing as far as can be done, similar situations and conditions, it is possible to forecast very nearly the results which would be obtained by the use of similar furnaces in other cities.

Before any place can contract for a cremating plant, it is necessary to determine approximately the amount of waste to be destroyed, and, in determining this quantity the greatest possible variation in estimates seems to be the rule.

In the New England states where the household offal is collected separately from other wastes, this work is by far better done than in communities where all classes of wastes are collected indiscriminately in one receptacle; but the quantity collected by the contractor or by the city teams, by no means represents the total production. Every place in New England as far as observation goes, allows private scavengers to come into the town with enclosed carts or tightly sealed barrels and go to the largest hotels, restaurants and boarding-houses, and take all the household offal for their own purposes. In many cases the process is entirely aside from the city collection service, and is under no inspection unless the scavenger has in use a leaky cart or other objectionable vessel, hence it follows that the quantity so removed can only be guessed at. As a general rule the amount collected by these scavengers is very nearly equal to that collected regularly by city machinery; and this must be taken into consideration when providing for a means of destruction.

The amount of general refuse or the combustible waste of a city, depends to some extent upon the manufacturing industries; every shop, store or manufactory daily sweeps out a quantity of packing material, scraps and other worthless combustible matter which is taken up with the ashes and carried to the dumps. The sweepings of houses and yards are of the same character and the whole of this together amounts to from twenty to thirty per cent. of the whole annual collection of the city. There is but little if any value to it, and when cast upon the ground, mixed with ashes and covered with earth, it makes a fairly satisfactory basis for the construction of streets and the filling in of low ground. But when this material is mixed with putresible matter then there is a very different state of things. Fermentation sets in, the growth of the lower forms of animal life is promoted, offensive odors are given off and the dump becomes objectionable and gives rise to complaints. It is so exceedingly difficult to separate the putresible from the unobjectionable dry refuse, and the latter being of real value to serve as fuel, that it is probable the wiser plan to cremate both of these classes of waste; the furnace being constructed so as to receive one or the other or both together without interference with its work.

Another class of city waste which has frequently caused some trouble, is the bodies of the smaller animals. As a rule the larger animals are contracted for and taken from the city by a rendering company; but the smaller ones, dogs, cats, etc., are of so little value, that they are often left to the health department to be removed. The cremating furnace when in regular operation will destroy as many bodies of this kind as can be comfortably put into it, with no loss of heat, and at the same expense as if burning household offal. There have been over sixty dogs burned at one time in a cremating furnace with perfect success, and to the great relief of the city authorities. When required, the carcases of horses, mules, etc., may also be destroyed. About three-quarters of one hour to one hour is required to destroy the bodies of the largest animals.

The question of the destruction of the contents of privy vaults by fire is one which I apprehend is not now under discussion. While the process can be carried on with perfect satisfaction to the city authorities, the expense attending it is greater than the cremation of garbage. Usually the material is from forty to

seventy-five per cent. liquid which has to be evaporated before the more solid portions are destroyed, requiring the use of a special apparatus to receive and retain the liquid, with a perfect certainty of the destruction of the odors arising therefrom. At more than a dozen places where the cremating plants have been erected in the last four years, the destruction of the contents of privy-vaults has been done by combustion in these furnaces day after day and year after year exactly as other waste of the city is destroyed. The quantities are not large, usually amounting from twenty to forty barrels per day, and in most cases, this special receiving apparatus is part of the construction of the furnaces. It will therefore be seen that it is possible to construct a cremating furnace which will burn its requisite quantity of garbage and afterwards destroy a moderate amount of the contents of vaults, and do both successfully and continuously, but naturally the cost of operation is considerably increased over what it would be for the destruction of garbage alone.

It is impossible in the limits of a paper like this to give a description of all the kinds of cremating furnaces that have been constructed in this country. There have been erected at least ten different styles of garbage cremating plants in this country during the last five years, only two of which have remained in active and continuous use. Every year brings forward some new device in this direction, which promises to revolutionize the country, but retires after an unsuccessful attempt to overcome the numerous difficulties, and falls never to rise again.

Of the two kinds of furnaces which have been longest in use, one has been more universally adopted, has proved itself to be of such character as to be equally useful in the tropics and the extreme northern parts of the country, and has been applied to the disposal of every class of waste that is possible to be produced. I refer to the "Engle Garbage Cremator," built by the Engle Sanitary & Cremation Company of Des Moines, Iowa.

The first cremator built by this company, five years ago, was in the nature of an experiment, and grew out of the necessity which then existed for the disposal of the waste of an interior city like Des Moines, where no sewage was possible, and where the value of garbage for any purpose of fertilizing was nothing. The original purpose of the inventor was to destroy organic waste from his own house, which having been accomplished, he introduced the same system into court-houses, schools and

county prisons, the next step being its introduction as a part of the municipal machinery of the city. Beginning with the construction of two furnaces the first year, the close of the fifth year has seen the building of thirty-one different cremators in twenty-three cities and towns, and in places ranging from the city of Panama on the Isthmus up the eastern sea-board to New York, and west to points beyond the Rocky Mountains. In twenty-one different towns and cities, the Engle Cremator has been in active and continuous use, two only having been given up, not for reasons connected with the furnaces but from other causes. It has been the aim of the Engle Company to construct their furnaces so as to insure the utmost strength and stability, consistent with a moderate amount of expense, and while at first cremators were constructed with the ordinary fire brick found in every locality, now they are built of special material which will insure the durability of the structure far beyond any similar furnace of this character.

A brief description of the Engle Garbage Cremators which are now being constructed for the World's Columbian Exposition, at Chicago, will best convey an idea of the operation of the latest improved construction of this kind.

The conditions under which these cremators are constructed are about the same as would apply to any large city. There are to be about one hundred and fifty restaurants within the grounds producing a large amount of offal. The "Shone" ejectors which are used to receive and convey away the sewage, will produce about ten tons per day of sludge which must be burned. There will be a vast amount of conbustible waste, the wrappings and covers from numberless packages, the sweepings and paper from the buildings, and besides this, it is probable that the manure from the stock Exhibit will also be destroyed ; the whole amount being from one hundred and fifty to three hundred cubic yards per day. To destroy this, two cremators are built back to back, both being connected with one stack. They are thirty feet long, both together being eighteen feet wide, and thirteen feet high. The stack or chimney is fifty feet high and nine feet square at the base, and is connected with the furnace by the neck containing a flue seven feet long. There are eight feeding holes, four on each furnace, controlled by sliding covers of fire clay bound with iron. Above is the house completely enclosing the furnaces, having doors on the outside

leading to the slopes, connected with the feed holes; these doors are reached by wide platforms around the building connecting with the approaches at the western end. The platforms extend across the end, affording an uninterrupted driveway around the building. The house is roofed with iron and is covered outside with "staff," a composition of plaster upon a ground work of bagging, the whole being cast in a mold allowing any shape or form.

The collection carts dump their loads directly upon the iron slopes leading to the garbage grates, no attention being paid to assorting or separating the various substances. Should there be liquid, this passes through the openings in the grates and is retained in the bottom of the cremator. The capacity of each cremator is about fifteen cubic yards at a charge, and this may be renewed every two hours or less, according to the character of the material or amount of heat applied. The fires, introduced from the oil burners at the end nearest the stack pass over and through the garbage piled upon the grates. Air, heated to five hundred degrees or upwards is admitted at various points through openings into the pile of garbage. The flame, smoke and other products of combustion pass the whole length of this upper chamber, and are driven down into the second row of burners placed at the front end. At this point the combustion is again reinforced by currents of air heated to a high degree, which with the burning gases of the material on the bars above, produce underneath the garbage grate a most intense and destructive heat. At the base of the combustion chamber in the neck between the furnace and the stack, at right angles to the current of flame and gas, is introduced a short but intensely powerful flame, which heats the chamber to a white heat. The resulting gas, the product of combustion. is discharged at the top of the stack — a colorless, imperceptible, highly heated gas which rises and is instantly dissipated.

The interior construction of the Engle Cremators is of very large blocks of fire clay; the side walls and roof being wholly of these blocks. The feeding holes are constructed of large blocks which weigh three hundred and fifty pounds each. The stoke-doors and the fire-doors are surrounded by special blocks made to fit the various shapes. The fire clay used in this construction is of a special character adapted to stand the heat of the steel smelting furnaces, which are used in Pennsylvania. The con-

struction of the cremators which burn gas is precisely on the same principle as the one described at Chicago for burning oil, as are the cremators which burn coal, with the exception that the fire-box at each end of the furnace is retained in the place of the oil burners.

The cost of this operation of destroying garbage, waste and refuse, is dependent upon three conditions. First, and mainly: the cost of fuel employed. Second: The character of the waste to be destroyed, whether containing much liquid or comparatively dry. Third: The amount of intelligence and skill which men display in managing the furnaces. The range of cost varies so greatly that it is impossible to predict what result would be obtained, unless every condition of the amount and character of the garbage, and absolute cost of fuel and labor are known in advance. Where fuel is low in price, as for instance, Birmingham, Ala., coal is \$2.00 a ton, and labor \$1.50 a day, the garbage is destroyed at a cost of about ten cents per cubic yard. When wood is used at a cost of \$3.25 to \$3.75 per cord with colored labor, as in Savannah, the cost is from nine cents in the winter to sixteen cents in the middle of summer to destroy a cubic yard of garbage and barrels of night soil. The reason of this difference is that the garbage in the summer has a very large quantity of waste material containing water, as watermelon rinds, etc., and more fuel and labor is required. Where coal is used at an expense of \$4.00 to \$4.50 per ton, the cost of destruction per cubic yard rises to fifteen cents, and may slightly exceed this during the summer months. Where natural gas is employed as a fuel at the low rates which are controlled by the cities, it is found to be one of the most economical fuels that can be used. The average cost being about twelve to fourteen cents per cubic yard for the destruction of garbage, animals, and a large amount of night soil.

The quantity of material destroyed in the furnace at Findlay, Ohio, using natural gas, during the month of June, 1892, was 568 yrds. of garbage, 394 bbls. of night-soil, seven horses, eight dogs, at a cost of ten and one-half cents per cubic yard and barrel. It should be noted that in destroying vault contents in these furnaces, a barrel of night-soil is considered equivalent in cost of destruction to a cubic yard of garbage. The relative cost of burning by oil is yet to be ascertained, but as shown by experiments which have been conducted it is undoubtedly cer-

tain, that where the garbage can be obtained in large amounts and the furnace operated continuously it is cheaper and easier than to use any other fuel; it is more manageable than coal and can be more readily applied. It is controlled by the turn of a valve and can be used either with steam or air, whichever is most convenient. Against this cheapness in the use should be put the cost of the steam boiler which must be used to spray the oil, and the cost of the piping and blower or air compressor, the whole being about one per cent. of the original cost of the cremating furnace. Speaking generally it may define this question sufficiently to say that the garbage of any place can be destroyed at a cost running from ten to sixteen cents per cubic yard, which is equivalent to twenty-five to fifty cents per ton, meaning of course the putresible waste of the town. Miscellaneous combustible waste of the town may be destroyed in quantities amounting from 100 to 150 cubic yards per day in these furnaces at a nominal cost for fuel, since the draught of the furnace is sufficient to burn this material with a very small amount of coal. Much depends upon the interest taken in the work by the men who operate the furnace. It has frequently been found that cremators are reported as not coming up to the standard, and the trouble has been the fault of inefficient workmen. It does not require anything more than ordinary intelligence to manage these furnaces, but there must be faithfulness.

The cost of these cremating plants vary with the size of the furnace required, with the locality where it is to be placed and with the local cost of material and labor employed. At the present time the furnaces are constructed in sizes which are relatively adapted to places like government posts or towns of 1,500 people, up to cities of 25,000 to 30,000 inhabitants, one furnace doing the work for each place. When the larger cities adopt cremation it is usually necessary to construct two furnaces in one locality near the centre of the population, or by constructing one at each side of the city, the destruction of all the garbage is insured within a short distance from the place of its production. It has been stated that the cost of hauling a ton of garbage one mile under ordinary conditions, is forty cents. Manifestly if this haul can be shortened to one-half, a saving of fifty per cent. is obtained which goes a long way toward defraying the cost of cremating the material. If the proposed location is of such character as to involve extra work

for excavating or blasting rock, or driving piles to obtain firm foundation then this item must be considered in estimating the cost of the plant. The policy of this Company is to make a personal examination before submitting estimates for proposed plants, and it is only when all local conditions are known that a price can be made which is satisfactory both to the Company and to the city.

In this connection it may be interesting to quote from the columns of the *Engineering Record*, which last week published an article giving the cost of construction and capacity of various English furnaces. It may be remembered that England has been experimenting in garbage cremation for about twenty years, that they now have about fifty cities and towns where refuse is destroyed by fire, and that no attempt has been made to treat this garbage in any other way than by selecting out such articles as appeared to be of value — iron, glass, leather rags and the like, — and burning the remainder. The process of reduction to obtain oil, and manufacture into a fertilizer as practised in Vienna, does not appear to be in use at any place in England.

The *Record* gives a table of 19 cities ranging in population from the largest to those of small size which have garbage destructors mostly of the "Fryer Pattern." Each plant includes a number of small furnaces called "cells" connected with a central chimney. Each cell is of a capacity of about one cubic yard, and is separately fired by its own fire grate, and destroying from four to six tons per day of miscellaneous city waste. The cost of these plants for each city varies from $70,500 for a plant which has eight cells and destroys 48 tons in 24 hours, down to $7,500 for one which has three cells and burns 18 tons in the same time. Taking all the cities together the cost is an average of $29,168 for each — but this is probably larger than is really the cost of most of them.

The cost of maintenance is variously reported from 8 to 48 cents per ton. The cost at the city of Blackburn where the most expensive plant is erected is 22 cents per ton, and at Leicester the cost has been brought down from 48 to 25 cents per ton.

In this same article an account is given of the crematory plant at the city of Southampton where 64 tons of miscellaneous garbage and refuse is disposed of daily, and the products of the

combustion — ashes and a manufactured manure — are sold for $1,500. The heat from this furnace is utilized to generate steam in a boiler employed to drive engines of 30 horse-power, which compress the air used for the "Shone Ejector System." The revenue from this source ($3,000) added to the amount from the sale of the combustion products pays all the expense of operation and the interest on the investment — and the plant is practically self-supporting.

The English methods of garbage cremation appear to be the treatment of every class of city waste, the separation in advance of the component parts of the waste, the destruction by its own fuel of that part which is combustible, and the utilization of the ashes for municipal purposes. The destructive methods are small furnaces each using separate fires, burning small amounts of material, employing a large force of hands and with an expensive construction of tall stacks to obtain the necessary draught. The operation is thorough as far as it goes, but not competent to treat so large a quantity as is done in this country at anything like the same relative smallness of cost for the works.

The employment of the heat to furnish power for different kinds of municipal work is as easily included in the American plant as in the English. The electric light of any city, where the garbage is continuously brought to a furnace can be furnished by the steam power of a boiler heated by the destruction of waste.

To summarize the results of garbage cremation in the United States, it may be said that the progress made in this direction far exceeds that of any other method.

The necessity for the prompt destruction of worthless matter produced by communities is pointed out and more urgently insisted upon by the health officials, is better understood and appreciated by the people, is called for by the public press, and the whole drift and progress of public sentiment is in the line of destroying dangerous and offensive matter by the quickest and most effective method.

It is positively demonstrated that this work can be carried on with entire sanitary protection, and at a very moderate amount of cost when compared with the results. This is a subject that each community must deal with and decide for itself, but each is able to profit by the example and experience of

other places where the destruction of dangerous matter has been successfully performed for years.

This was followed by a paper from Mr. I. M. Simonin on

"THE SIMONIN PROCESS FOR TREATMENT OF INFECTED ARTICLES."

Mr. Simonin addressed the Association as follows :

MR. PRESIDENT AND GENTLEMEN :

To be permitted to address this learned and honorable body is an honor of which any man might well be proud ; and I should indeed be unmindful of my privilege did I not most thoroughly appreciate this evidence of your confidence ; therefore, Mr. President and Gentlemen, permit me to thank you most sincerely for this mark of distinction. New England, the acknowledged leader in art and culture, stands out prominently as the one central figure in the sanitary arena ; and the other states of the Union, before approving of and previous to adopting any hygienic measures, almost invariably demand that the proposed improvement bears upon it the stamp of approbation of the New England health authorities.

I am here to-day to speak to you briefly of the process now in use in the city of Providence, Rhode Island, for the sanitary disposition of kitchen refuse, and the disinfecting of infected materials. No question of municipal government, Mr. President, plays so important a role or occupies a more prominent position upon the desk of the health officer, than does the problem, what shall we do with our refuse ?

It is the vital, the all-embracing, the all important question which to-day confronts the sanitary authorities. The system or process, if you will, first introduced at Providence, is the invention of my father, Mr. C. F. Simonin, in the year 1869. Although his process was, and is to-day, recognized a thoroughly sanitary one, it was not brought at that time to public attention, as a means of disposing of vegetable refuse, for the reason that it could not be operated for that purpose, except at a large financial loss. It is known as the Naphtha Vapor Process, and has been in use for more than twenty years as a method of treating animal refuse, and other materials known to contain

an excess of grease. This was fully explained to the Company composed of public-spirited citizens of Providence, who proposed, in conjunction with their Health officer (Dr. Chapin) to introduce this system; and they, recognizing the evil of the means at that time used for disposing of this material, were willing to introduce this system, which their Health Officer considered the only sanitary one then in existence; stating that, if it was not a commercial success, they would ascertain the amount of financial assistance necessary to be obtained from cities in order to make it so. The Providence works were started about April, 1890, and the eight months they were run by the Company fully demonstrated that the process, while a sanitary one, could not be worked without considerable loss. Having conceived a number of ideas, the introduction of which we knew would not only improve the process from a sanitary point of view, but also reduce the expenses, I leased this plant. and introduced the process covered by letters patent, granted January 5th, 1892, to I. M. & C. F. Simonin. It has been fully proven in the time (two years) that it has been under my control that it is not only practical to introduce this process in large cities, but in any location where they will deliver daily five tons of refuse material; and we are prepared to build such works, if favorable contracts may be had at a price much below that for which the same can be cremated or treated by any other process.

The refuse material received at Providence without removing any of the tins, bottles, rags, etc., which necessarily are mixed in large quantities with garbage, is placed on iron cars, which are at once run into an iron tank, called an extractor; and it is there subjected for about twenty-four hours to hot naphtha baths. The first application of naphtha destroys all germ life; and precipitates most of the water that is mechanically mixed with the garbage. A number of applications thoroughly dries the material and frees it from the grease and oil present. The mode of receiving garbage at Providence is not only primitive, but unsatisfactory to me. These, however, being the first works built, and having no knowledge of the objections likely to result by exposing a mass of this material, no provisions were made for properly receiving the garbage. As the material for this process is not assorted when received, and as it is the only utilizing process of which this can be said, all of it being

placed at once in the extractor, it is possible for any good mechanic to devise an air-tight pocket that will receive the material as soon as it is delivered at the works; and from these pockets it can readily be placed in the extractor without so much as offending the sense of sight. If the tins, rags, etc., must be removed from the garbage, which is the case where it goes into a dryer, it ceases to be a sanitary measure. These offensive materials being harbingers for the spreading of disease in many households. From the commercial point, the works at Providence are poorly located; long hauling being necessary for all coal delivered and all products shipped; and under the present contract, which has but a short time to run, it would not pay to put these costly improvements in; but at the plant now being constructed at Cincinnati, all necessary improvements for the receiving of garbage have been introduced. Improvements for the receipt of this crude material must be made by all systems; and to this point all processes, if the material be not assorted before going into the pockets, are similiar; and it is from this point, after the garbage is received from the pockets, that all systems must be judged. It has been asserted that to operate this process there is danger from fire. In answer to this asseveration, I will say that for a period of over twenty years in Philadelphia we have worked the naphtha vapor process, and in that time there has never been an accident or a fire. In corroboration of this statement, I would say that an insurance at a low premium is carried on all the buildings and machinery at Providence, and a casuality insurance on both the workmen employed there and the public is carried and is classified in the least dangerous class. This fact sufficiently proves its safety.

The different kinds of animal and vegetable refuse treated retain their original shape: consequently we claim that it is applicable by this process to treat not only animal and vegetable refuse, but all dead bodies, and by varying the process slightly, we can treat human bodies, and while killing the disease germs, do it without any injury to the body.

The material is taken from the extractors and ground, and finds a ready sale as a fertilizer. A quantity has been sent to Germany, and is there being experimented with as an animal food. It is pure, far more so than the food as it frequently comes to our tables. It has been proven that the meat one

eats, the milk one drinks, etc., are tainted with many diseased germs. This process not only destroys these, but the resulting product being free from grease and moisture, ceases to be a fertile ground for the growth of baccilli. The serious objection to the introduction of this process and all other sanitary measures, is a lack of power delegated to cities to make contracts for a sufficient length of time. If introduced into cities, contracts can be given only for a short period, and the charges must be excessive, in order to protect the capitalist, should contracts not be renewed. To obtain the cheapest return, the city should not only have power to make a long contract, but be empowered to build its own plant.

At Cincinnati, our Company made two bids; the first one being fifty per cent. lower than any of our competitors, equalling 42 cents a ton, and we supplying our own apparatus. The second proposition made by us was to build and erect a complete plant at the expense of the city, and we then to manage it under a lease, and consume the garbage of the city at about ten cents a ton. The second proposition, while saving Cincinnati about $250,000, was decided by its solicitor to be illegal, as it required a special enactment of the legislature to make such a purchase.

This process is the only system that is applicable as a sterlizer, by which all infected material can be treated without injury to the flimsiest fabric; and most materials treated are improved; bedding, clothing, draperies, carpets, furniture, etc., by this process are made moth proof. Many materials, such as leather and glued furniture, which are destroyed by hot air or steam sterilizers, can be effectively treated by this process without injury.

If this system was in operation at every seaport town, we should be fully equipped to fight infection likely to be brought to us from foreign shores, and not be, as we are, unprepared to meet the dangers that threaten us particularly at the present time. Most of us have read the recommendation of Surgeon-General Wyman, that a sterilizer be placed at Ellis Island, New York City, so as to be prepared to disinfect cargoes infected by cholera. Does not the same danger threaten us at all our seaports? It is a fact fully established that epidemics start from carelessness exhibited in places where we least expect it, and which are poorly prepared to combat a disease. Once having gained a foothold, it must run its course. That inefficient

and careless collections of kitchen refuse have been the rule in most cities is a fact well known to you all. One merit which we claim is that under the system we propose, the greater the amount received by just so much lessens the average course of treatment. Consequently by this process close collections are encouraged. The contrary is the case where no marketable product is produced, as is the case of a cremator.

Permit me in conclusion to state that the enlightement of the present age, the rapid strides intelligence is making in all directions, indicate that destruction should not be encouraged or advocated by sanitarians, and particularly is this true with products so valuable as your kitchen refuse.

The demand for both animal and plant food is increasing every year, while the sources of supply do not increase in the same ratio. It is the duty of scientists to supply this want; not only by saving that which we now waste, but by constantly striving to increase the avenues of supply. Far be it that this learned body, or any member of it, endorses the introduction of these instruments of destruction.

I take this opportunity, Mr. President, to acknowledge the valuable services of one of your members, Dr. Chapin of Providence, in fostering this industry in its infancy. You, who have had the benefit of his advice in your deliberations know better than I his merit, and the unselfishness with which he gives his time and talents to matters that are of benefit to the public. I also desire to express my appreciation of the work done in this cause by a noted sanitarian in the West, Dr. Prendegarst of Cincinnati. It is to him and his able assistants in the bacteriological department that we are able to demonstrate the efficient and quick action of hydro-carbon, the re-agent used in this process for the destruction of germ life.

Tests are still being made under his supervision, and the results will be published as a supplementary report to that contained in the *Annals of Hygiene* which is herewith attached.

THE CHAIRMAN. Dr. Field of Lowell is announced to open the discussion, and I will call upon the doctor.

REMARKS OF DR. J. B. FIELD.

MR. CHAIRMAN, I think there is no need of my saying anything about the necessity of destroying garbage. I think all

boards of health will agree with me that it is necessary. We do not want to put all the garbage on the dump, neither do we want to feed it to swine, and least of all to the milch cow. I think we all agree that the garbage should be destroyed or its charactertstics changed. The question is how best to accomplish this, whether by one of the two methods brought before us to-day, or perhaps by some other method. As to which is the best method, I think no one can say positively. One method may be better adapted to one locality, and another to another The whole subject is yet, as we might say, in its infancy. In considering this subject of the destruction of garbage by cremation, we must take into account the effects of the method, its liability of creating a nuisance, and the expense of the method. Any method must destroy the garbage thoroughly or change its characteristics thoroughly, so that it will be harmless. I can personally testify that the Engle Process does so, and from the testimony of others it would seem very certain that the Simonin Process does change the characteristics of the material. As to the matter of freedom from nuisance, I can also testify that the Engle Process, as I have seen it, creates no nuisance. I wish I also had the pleasure of seeing the Simonin Process so I could testify as to that. The matter of expense is a difficult one to decide. When the city of Lowell some four or five years ago began on this idea of destroying garbage, we visited the plants that were then in operation. Our attention was first captivated by the Merz Process in Buffalo, and when we were informed we could get something valuable out of this worthless material, it appealed to us favorably. A member of our Board of Health went to Buffalo and found it cost more to extract the valuable constituents of the garbage than to destroy it, and moreover the process as reported by him created quite a nuisance. We next turned to the destruction of garbage by cremation, and after looking at several devices, the Engle furnace seemed to be the best one. I need not say anything about the construction of the furnace, as that has been spoken of by Col. Morse.

Another point to be considered is the size of the city. Supposing two processes are equally good, the Simonin Process, for instance, and the Engle Process, it is a question whether the one process would not be best adapted to a large city and the other process to a small city. If a process requires a large and elaborate plant, it would seem that for a city of the size of

Lowell such a plant could not be constructed except at great expense. Of course, there are some advantages, as has been said by the gentleman who read Mr. Simonin's paper, by not destroying bedding and clothing; on the other hand there are certain advantages by completely burning them. There may be articles which we wish completely to destroy, and, if so, there is no better disinfectant than fire.

Then as to whether the plant should be operated by the company under contract, or whether it should be owned by the city, there is something to be said on both sides. Under a definite contract for a term of years the city knows just what it is going to cost. On the other hand, if the plant is owned by the city, and operated by the Board of Health, there will be as little nuisance as possible. At Lowell we have to watch the contractors collecting night-soil, and we keep inspectors for that purpose. If the city collected the night-soil, it would do so in order to get rid of it with the least nuisance possible. So, if the city destroyed the garbage, I believe there would be a liability that the work would be done with less nuisance, than if done by contractors.

In regard to the city of Lowell I can only say we have been at this for five years. When we began it was a hard thing to convince members of the city government that this was not a fancy or hobby of the Board of Health, some pet scheme they liked to talk about, but we have kept at it. We have taken the city government around to see different works, and for the two past years we came very near getting an appropriation for a furnace, failing once because of politics, and a second time because a city father kept swine, but this year we got an appropriation, and then thought that it was going to be plain sailing. Unfortunately it was not. Immediately there arose the question of a site, and this will be the case whatever process is adopted,— where will you put your furnace or extractor, or whatever you may call it? Of course the shorter the haul the better. It may be safely located in any place where a manufactory, a tannery, or anything else of that kind may be located. There may be some smell, but it will not be dangerous to health. We looked over several sites, and found one. At first there was a temporary injunction served upon us. We had to appear in court, and the judge very wisely took the ground that there could be no nuisance until one was created. He said the city of Lowell should be permitted to erect a fur-

nace and then when the furnace is up, if it is a nuisance, we will grant an injunction.

The CHAIRMAN. Dr. Chapin of Providence is not here, and I will call next upon Mr. J. C Coffey, of Worcester.

REMARKS OF MR. J. C. COFFEY.

MR. CHAIRMAN, I have a word to say in reference to this subject. I had the good fortune to see the Engle system at work at Coney Island, New York, some two or three years ago. I saw also the Merz system in operation at Buffalo, and I saw the Simonin system in operation in Providence this last summer. The Merz system of course is out of the question. It has been a failure, I understand, and I do not wonder at it, from what I have seen of its operation in Buffalo. The Simonin system and the Engle system, in my opinion, can be run without creating a nuisance. That being the case, it simply resolves itself into a question of expense. Which is the cheaper system to cities and towns? It is not any advantage, in my judgement, that a fertilizer is obtained unless that fertilizer can be obtained at a cost that will render it practical, and so it seems to me, to resolve itself into a question of expense. Of course, it is to be taken into consideration that the Simonin system not only treats garbage, but will also answer for disinfecting bedding, furniture, draperies and things of that kind. Under the present process of fumigation we must almost entirely destroy these things, so that every health officer who has an experience of that kind knows what an annoyance is caused by fumigation, especially that of draperies and furniture and things similar, which by the carelessness of the household are allowed to remain in the room where a sick person is. In some places we find articles are more or less damaged, and it creates a great deal of dissatisfaction, a great deal of trouble. Of course, a great advantage of the Simonin process that ought to be taken into consideration, is that it can treat those things in addition to treating garbage, and, as I said before, it is simply a question of expense, which one is cheaper. Both, in my judgement, after seeing them in operation, can be run without creating any nuisance, so it is a question which is cheaper for municipalities. Of course, it is difficult to tell that until they have demonstrated it in some more satisfactory manner than either of them has as yet in this section of the country; and, as a member of the Board of Health of

Worcester, interested in seeing what Lowell's experience would be, as that city is a typical one in this part of the country, and about the average size, I think there we will get a great deal of valuable information after they have run it awhile ; but there is no doubt in my mind, as I say, after seeing both, that they can both be run, and run where any manufacturing establishment can, without giving any reasonable cause of complaint.

The CHAIRMAN. Mr. Twitchell of New Bedford is not present, and I will therefore call upon Mr. H. F. Hurlburt, of Lynn.

REMARKS OF MR. H. F. HURLBURT.

MR. PRESIDENT AND GENTLEMEN, I arise with a good deal of diffidence, perhaps unusual to my profession, to address a body of gentlemen upon the question of the disposal of garbage, for the simple reason that until the first of February or March of this year I never had any connection with the Board of Health or gave the matter of the disposal of garbage any study or thought; but, unfortunately perhaps for the city, it certainly has been at times unfortunate for ourselves, the city officials have seen fit to place Mr. Lacroix, Dr. Little and myself upon the Board of Health, and none of us have had any experience in matters regarding the health of the public. After we came into the office, we found upon investigation that our garbage collected from the city, varying from twenty to thirty tons a day, was deposited down upon the marsh near the sea-coast, and that it had been so deposited for a number of years. I had known that there was constant complaint from the citizens of that section of the city on account of that crude way of disposing of the garbage. While as a citizen I felt it was a great outrage, as a lawyer it was the source of income to me, as I had two or three suits against the city for which they paid me fees, and damages in some of the cases. We then knew that this nuisance must be abated, and we undertook to find out for ourselves what was the best way of disposing of garbage. We sent to sanitarians of the country, and sent to boards of health, and investigated the matter of crematories and what sanitarians said about them, and read up the history of different crematories. We found that they were not a success, any of them, and many sanitarians who were opposed to crematories were

saying they were injurious to public health because the germs were not destroyed by fire, and they floated up through the smoke and circulated through the cities and towns, and so we were very much terrified about introducing a crematory for fear we would have a cloud of germs above our city which would settle down upon us and create an epidemic. We then heard of the Engle crematory, and Colonel Morse came on to see us, and, of course, he told us his was the only crematory in existence, that everything else had been a failure, and his had been a success. We were willing to agree with him, because we could not contradict him. as we had never seen it work, so we read up about the Engle Process.

Now, with all due deference to Col. Morse, my experience in regard to crematories is this, that we have not had any proper tests of the crematory under the conditions we have in New England. You may go down South and go in the western part of the country and erect a crematory, and it may work very well in those places, but the conditions are not the same as in New England, especially upon our sea-coast. The cost of labor and coal is a very important element that enters into the cremation, and assuming that the crematory of the Engle people is a perfect one as a matter of sanitary condition, yet it has not been demonstrated to us that the Engle furnace is the crematory we should put in here, if we decide to put in a crematory, for the simple reason that the conditions have not yet been like those that we have in New England, and do not satisfy us that we can apply it with advantage to the city and at very little expense. Now, about the matter of wood and coal in the South, of course, the Colonel has told us what it costs, but when you have to pay up here for coal all the way from five to seven dollars a ton, when you have got to pay labor the high wages that we have to pay here in New England, employing men who are capable of running the furnace, the cost of the cremation becomes a very serious question, and, until we have some further light upon the matter of economy in addition to the matter of health, it is a very serious question with us, and we cannot decide in favor of the crematory.

Then we heard about the Simonin Process. My associates went down to Providence and investigated the Simonin Process. We read about the Merz Process, and I thought that was the finest system in the world when I read what was said about it.

Some sanitarians said everything else was a failure, but the Mertz system was the acme, and that any city that was without the Mertz system was ignorant and barbarian and did not know what was good for itself. So I became quite enthusiastic over the Mertz system, and thought that was going to be a very good system for us. We investigated that, and we found that in Buffalo it worked for a while, and then through the carelessness of some man the city did not carry it on. That was the excuse given. It was used in other places, and dropped there for very good reasons, but in no case was the Mertz system a failure, so it was claimed, but its abandonment was for other reasons. We found then in order to construct the Mertz system and run it we had got to mortgage the entire city, and we didn't want to do that.

We then saw Mr. Simonin, and he explained to us his process, and told us what a great benefit we should get if we used his system. I am not going to contradict him ; it may be so, but I have not seen the Simonin Process as yet in operation in such a condition that they will stand right up and say, " Here it is gentlemen ; here is our perfected system." They tell us in Providence it is not a perfected system ; the theory is all right, but they have not introduced their more modern ideas, and it is not the perfect system they would like to have it at the present time ; but when the Simonin people construct a plant which contains all those ideas and it works practically, I am inclined to think I will agree with them. Neither have the Engle people. That is the condition we found. They have the perfect thing in theory, and they will have something constructed that is perfect, but the plants they had constructed did not contain the more modern improvements, but as soon as they put in the new improvements, everything will be perfected. Now, I think in Lynn we will have to wait until Mr. Engle has his constructed with all the modern improvements, and we can be sure it will not cost a dollar a ton to treat our garbage, and that it will be satisfactory in other respects, and then we will consider that system ; and when Mr. Simonin proves his system in a like manner, then we will consider the matter of the Simonin Process, but we are not in condition, and I do not think any city is in a condition, to make a contract with the Engle people or with the Simonin people to construct a large and expensive plant until they have demonstrated their system by the erection

of a plant somewhere under conditions somewhat similar to our conditions in New England. No city would be justified in incurring a large debt or entering into a large contract until they have perfected their systems. I have not any doubt, I can say here, in regard to the Engle crematory, that the Engle crematory, from our investigation of all crematories, as a crematory, is the best, and from the investigation that has been made of the Simonin Process, so far as we could ascertain the theory of the Simonin Process, that is certainly one of the best, if not the best, but until their plants are put into practical operation, until these modern ideas and these modern improvements that they say they have, but which they have not yet introduced, are placed upon the plants, we are not in condition to say we will have a crematory or an extracting process.

Now I wish to say a word in regard to the disposal of night-soil. I do not understand the Engle people guarrantee to dispose of night-soil in their crematory. They talk about it; they say it will do it; that they can destroy and have destroyed so many barrels here and there, but I do not understand the Engle people are ready to say their furnace is constructed for the disposal of night soil, and when we pin them down to the question whether they will guarrantee their apparatus for that purpose, they admit that it is better for us to take the night-soil out to sea than burn it in the crematory; and that is an important question to consider. Until we are satisfied the crematory will destroy night-soil, we do not feel it is wise to adopt it.

Now, in regard to the Simonin Process for the extraction of the deleterious matter from garbage, drying it, and after it is dried grinding it up and using it for fertilizing, we still have the problem of disposing of our night-soil. We have thought in order to avoid this great nuisance in the city of Lynn of having a scow constructed, and towing it out to sea. In the city of Boston, I understand the cost is about ten cents a ton for towing it out to sea, but we cannot do it in the city of Lynn, because we will collect about thirty tons a day, and that will be one hundred and eighty tons a week, and it will cost somewhere between seventy and eighty dollars for the towing alone. Then we have the cost of the men upon the scow, and the cost of a man to oversee them; we have the interest upon our plant and labor, so it will cost us between fifty and seventy-five cents a ton to take our night-soil and garbage out to sea, and the

only question is what the result in the future is to be. If Boston and all the cities upon the sea-coast are going to adopt that system of taking their garbage out to sea, and continue it for a series of years, the question comes whether we are not going to create a greater nuisance by having some of it float back upon our sea-shore, and disturb the people who live there. If all of us do it, it seems to me sooner or later it must create a nuisance of such a character along our sea-coast that it will not only destroy beautiful property, but also destroy the health of the inhabitants.

Now, that is the way we are situated in Lynn. As a member of the Board of Health, and I think I voice the sentiments of my associates, though we have given the subject careful attention, we have yet failed to see a gentleman representing either process who can say, "Here is a plant that will do everything that we say it will do." When they do say that I am going to make up my mind which one I prefer, but now we can prefer neither one nor the other. I speak as a layman. I know nothing about the scientific disposal of garbage, but that is the way we look at it at the present time.

Mr. Simonin. Mr. President, I wish to make a few remarks in answer to my friend Mr. Hurlburt. I should like to say the Simonin Company have not any modern improvements to put in their process. We have improvements by which we would like to handle and receive garbage, and these improvements all systems must adopt. I refer to the use of air tight pockets to hold the refuse when it is delivered. To substantiate that we consider our system perfected. I should like to say that we are ready to give bonds for a term of years that we will fulfill our contracts. This should sufficiently answer Mr. Hurlburt's criticism. If we are going to receive garbage at the rate of two hundred and twelve tons a day, as they deliver it in Boston, you must have receptacles to receive it so that it cannot be seen. That is the only improvement we desire to put in so far as our plant is concerned. Our bond covers the terms of our contract, and this is what we ask of our crematory friends, that they will give bonds for what they estimate it will cost per ton to consume the garbage, and these bonds should hold good for a number of years, so that the city is protected.

Chairman. The subject is now open to discussion.

Dr. S. H. Durgin. I understand, Col. Morse, that with your process you dispose of not only garbage but other refuse matter?

Mr. Morse. Anything that the fire will touch, everything that can be destroyed by fire.

Dr. Durgin. Meaning by that every waste material of a city other than ashes ?

Mr. Morse. Therefore we should require the larger proportion of ashes to be taken out.

Dr. Durgin. But street sweepings and house dirt ?

Mr. Morse. House dirt ? Yes.

Dr. Durgin. Not street sweepings ?

Mr. Morse. No, sir. As a rule, it is not reckoned as part of the garbage of the city. The street department take that up separately from every thing else, and treat it separately.

Dr. Durgin. In what cities and places are your furnaces now operated ?

Mr. Morse. In Des Moines, Iowa ; Butte City, Montana ; Salt Lake, Ogden, Utah ; Dallas, San Antonio and Paris, Texas ; Panama ; Tampa, St. Augustine, Jacksonville, Florida ; Brunswick, Atlanta, Savannah, Georgia ; Norfolk, Richmond, Virginia ; New York City, Coney Island ; Findlay, Ohio ; the World's Exposition, Chicago ; Lowell, Massachusetts. Furnaces are now being built in Chicago and at Lowell. There are furnaces projected but not begun in Iowa, and in Texas there are applications for furnaces which will probably be undertaken next month ; also at Topeka, Kansas, and at Denver, Colorado ; there are a large number of other places where small crematories of various kinds are being used, but which we never count in the general list, being used in school-houses, hotels, manufactories and hospitals, and are never counted as public crematories.

Dr. Durgin. Is it your method to sell the right to erect or to erect by the company and sell or lease to the city ?

Mr. Morse. The method of the company is to build and sell, for the reason that it being a complicated construction, the company builds the furnace, charges a moderate price for the work, and then turns it over to the city. Everything the company owns under the patents becomes the property of the city. It makes a guarantee of a year so that should there be any defect in the construction, or in the material, or in the operation itself by reason of failure of the principle, then the company are responsible, and assume the responsibility of making it good. The perfect construction is the main thing. In order to get that perfect construction the company builds them, and

the city buys the furnaces just as they would buy any piece of any municipal machinery, whatever it may be. Then the city operates it Naturally, if there is any saving under the contract price of operation which is guaranteed by the company, then the city makes the profit. The cost of the furnace is one thing; the cost of operation is another thing, and both these items have to be considered separately. There is no royalty.

Dr. Durgin. How do you fix the price to a city?

Mr. Morse. That is usually done by the number of inhabitants of the city.

Dr. Durgin. Supposing the plant costs $100,000 to build or $500,000. What is the cost in that case to the city?

Mr. Morse. That would be an unknown quantity. You cannot very well estimate in that way. For instance, take the city of Boston. Supposing the question were asked what we would do, the company would say, "We will build a series of furnaces which will cremate the garbage of the city of Boston." We will ask for this a sum of money, we will say, for instance, one-half of the contract proposed by Mr. Simonin. We will guarantee that these furnaces shall be competent to do the work; we will guarantee to do it also without creating a nuisance, and to the satisfaction of the city authorities, and that it shall not cost to consume more than a certain amount per cubic yard or per ton. Now, when all the conditions of this contract are fulfilled, it then becomes a matter for the city to carry it on, precisely as the city would go into the market and after trial of any piece of machinery, like waterworks or anything else, would buy it with a proviso and guarantee that it should do the work in a certain time, and should it fail through any defect of the machinery, it should be made good by the company.

Dr. Durgin In what way do you guarantee that the plant will do a certain amount of work?

Mr. Morse. By actual test in the construction, and run for a given amount of time, a week or a month. If we destroy the given quantity of garbage for a given time at a given cost, that fulfils the contract. Now, if we do that ourselves, under our own men, and then transfer this to the city, and see that the city's men are competent to do the same thing, we say that the contract is fulfilled.

Dr. Durgin. That is, you run the plant for a certain time,

long enough to determine the amount it is able to destroy and also the cost?

Mr. Morse. Yes sir.

Dr. Durgin. And that is —

Mr. Morse. The consummation of the contract.

Dr. Durgin. The guarantee?

Mr. Morse. It is a difficult thing if the gentleman will allow me, to make any figures for the cost. When a man sells a piece of goods he does not always give the cost mark. If you should ask me what the cost of the erection of these furnaces is, I can simply tell you that is a matter which the company reserves to itself, but taking the question generally, and considering it from a broad standpoint, we can say this, that a city of fifteen hundred to two thousand inhabitants would want a furnace which would cost approximately $3,000, what we call a number one; that a city of five thousand would want a number two, which will destroy from five to fifteen cubic yards or its equivalent in tons. I reckon somewhere from two to two and one-half cubic yards to a ton. That would cost somewhere from five to six thousand dollars. I speak of these thing generally. There can be at this moment no definite calculation about it. A city having from six to eight and twelve thousand people would require furnaces of larger size, number three, which would cost them somewhere from six to seven thousand, or seventy-five hundred dollars. The next and largest size which has been put up, the size called number four, which has been used by cities of fifteen and twenty-five and thirty thousand people,—the city of Jacksonville, Florida, with 25,000 people, destroys all its garbage, all its night soil, and all its refuse in a furnace of that kind. That is perhaps the best test that has ever been made. The city of Savannah with fifty-five or sixty thousand people, destroys with two furnaces all its garbage, all its night soil, and all animal collections. That experiment has been going on two years and a half now. Sixty thousand people will require two furnaces, thirty thousand people one furnace, and the cost varies all the way from ten thousand to fifteen thousand dollars, so it is quite possible that a city in New England which wished to erect a furnace of that kind to do the work in the very best way would have to pay $15,000. The English furnaces cost a great deal more, and their experience points this moral, that in destroying every kind of offen-

sive material, you must do it with reference, first of all, to the sanitary side of the question. You must provide for the health and comfort of the people; after that comes the cost. Now, in this case, if the city of Lynn had thirty tons of garbage, I believe it could be burned on that street opposite the hall with entire safety to the people and without offence, and as reasonably as it could be treated in any other way, certainly far less than taking it out to sea. I have always been unwilling to give figures without examination of conditions, and gentlemen can see it is because of the fact that conditions vary so in every place that you can hardly apply one city's figures to another; but the statement I have made will give you a general idea of what may be done with cities of varying size.

QUESTION. I would like to ask Col. Morse what figures he can give us of the work in the city of Norfolk, Va.

Mr. MORSE. I have only the report from the city engineer who has charge of the work there, giving the quantity. I asked him a few days since to forward me the figures, but I have not received them; but I have had reports come to me like this: For the month of July there were 1,350 loads of garbage. Now, it is well known that all the fruit and vegetables for New York goes through Norfolk. There is, therefore, an immense amount of vegetable matter. They burnt in July, 1,350 loads of a yard and a quarter each, for their carts are very large. In August they burnt daily — this is the computation they gave me, 85, 87, 98, 60, 40, 44, 80, 35, 30, 70 cubic yards. The average amount will run somewhere near 65 or 70 cubic yards per day. It should be borne in mind that it is entirely vegetable matter, — water melon rinds and the like. Water melons down there are the food of the negro inhabitants. I cannot state the exact figures of cost, but I do know this, that the president of the board of health came to me and said, "We have now a crematory this summer where last we had none, and feel entirely protected from cholera or anything else. It has been of more benefit than anything else that came into the town."

QUESTION. Do you take care of night-soil?

MR MORSE. No, sir. The night-soil is taken care of in other cities by furnace, but not there.

QUESTION. In regard to ashes, what per cent. is there?

MR. MORSE. As nearly as possible, there is ten per cent. of ashes remaining from the destruction of this matter.

Question. Is there any commercial value to it?

Mr. Morse. There is a value, but there is a large amount of debris and sand in the ashes and other matters of no value connected with it. If you screen this matter out, you get about five per cent. In other words, if you burn 2,000 pounds of garbage, you get somewhere about 100 pounds of valuable material which can be used for fertilization. Down in the southern countries it is valuable for use on orange groves. None has been used, as far as I know, at Coney Island. It has been used at Savannah and at Norfolk, and used very slightly in some other places, but there is an undoubted value of five per cent., which goes a long way towards paying the expenses of the work.

Mr. Hurlburt. Col. Morse, is it not a fact that your company merely recommend the use of your crematory for the disposal of garbage, saying that it can be used to consume night-soil, or it may be used?

Mr. Morse. I may say it is, yes.

Mr. Hurlburt. Now, is it a fact, assuming that a city should see fit to make a contract with your company, that you can give a bond guaranteeing the destruction of night-soil in that crematroy.

Mr. Morse. The company would do this. If the garbage was to be destroyed, the furnace may also contain a limited amount of night-soil. If the amount of night-soil ran over twenty barrels a day, they would build a crematory for that purpose alone. We can use our garbage crematory for a certain limited quantity. You cannot use it for a large amount of night-soil when you are using it for the destruction of garbage, on account of the evaporation in destroying night-soil.

Dr. Durgin. You stated that in one place the cost was 15 cents per cubic yard, where was that?

Mr. Morse. I think that was at Savannah, — the cost for labor and fuel at Savannah. One curious thing, in the city of Chicago a few weeks ago they asked us to make a sworn affidavit; there was no getting away from them. We obtained and produced a sworn affidavit from the city of Savannah and from Ohio, in which a man swears to the fact that it costs 9 cents per cubic yard for the month of March, 12 cents for the month of June, and 16 cents for the month of July.

Dr. Durgin. It takes about two and one-half cubic yards for a ton?

Mr. Morse. Yes; that is, it will take two and one-half cubic yards of household offal and miscellaneous refuse. There

is no separation of the household waste. It is put in together with all the waste of the whole city, garbage and refuse given together.

QUESTION. It would cost in the city of Boston then considerably more than it would cost in the city of Savannah ?

MR MORSE Probably it would cost about 45 to fifty cents.

DR. DURGIN. And this in addition to the cost of hauling. You require in your process that the city shall deliver the material at the furnace ?

MR. MORSE. Yes, sir.

DR. DURGIN. I understand, Mr. Simonin, that that is also your requirement, that the city shall deliver the material at the furnace ?

MR. SIMONIN. Yes, sir.

DR. DURGIN. Is your process in operation anywhere in the States except in Providence ?

MR. SIMONIN. No place except in Providence and Philadelphia. We have in Philadelphia several extractors, but the system has not been adopted at Philadelphia, as we have made no proposal to that city. We put in three extractors to demonstrate what can be done by our system, and these are run for our own private account, and not under contract with that city. The works at Providence have been running about three years, and without the slighest expense to that city.

DR. DURGIN. There seems to be a general consensus of opinion in regard to the ability of these two processes to do the work without nuisance, and doing it well. There seems to be the question left as to the cost, and we have obtained from Col. Morse considerable in regard to the cost. I would like to ask Mr. Simonin what he can tell us in regard to the cost of dealing with this material by his process.

MR. SIMONIN. Well, we can only refer you gentlemen, to the proposition made to the city of Boston. We ask the city of Boston to buy a plant the same as they would buy the furnaces, and we will then manage the plant and consume the garbage, without any expense to the city, but on the contrary, we will give the city an equivalent of six (6) cents a ton, and for the faithful performance of the contract, we give a bond of $25,000. The bond binds us for twenty years. Our plant may possibly cost double, but instead of costing fifty cents for labor and coal a ton for burning,, the estimate given by Col. Morse for cremat-

ing, which estimate does not allow for depreciation and repairs, we will pay the city for this refuse, which will save the city the first year the difference in the original cost, and for nineteen years thereafter the city will not only have its garbage disposed of free of cost, but receive a revenue, and our bonds are given to protect the city.

Dr Durgin. That amount is to remunerate the city of Boston or any other city for its outlay and interest on its plant?

Mr. Simonin. It will pay one-half of the interest. I believe the city of Boston is paying four per cent, possibly the city can get it for much less than that. The amount we pay the city is equal to two per cent. on the cost of the plant, and it will cost them two per cent. on their investment. We keep the apparatus in repair, and our bonds guarantee that at the end of the contract that we will deliver it in good working order.

Dr. Durgin. Have you reduced that to the cost per ton?

Mr. Simonin. The cost per ton is about six cents. Two per cent. on $160,000 is $3,200, which is the payment to the city on a plant that will treat about 52,000 tons a year.

Dr Durgin. That is the net cost to the city for burning its garbage?

Mr. Simonin. Yes.

Dr. Durgin. In addition to their delivering it?

Mr. Simonin. Yes, of course, they must deliver it to our plant, as they will have to do to any system they adopt.

Question. Do you make a similar offer to other cities?

Mr. Simonin. We are willing to make it, yes.

Question. To a city of small size, 25,000 people?

Mr. Simonin. If a city will deliver us five tons of garbage, yes Of course the smaller the plant the more expensive per ton it is to work, but we feel free to say to any city in this location that will buy its own plant, that we will manage it without expense.

Question. How in regard to a city like Newton?

Mr. Simonin. We are prepared to make you an offer, but the work might be done somewhat cheaper, if we build a plant large enough to be used by several adjoining towns. If we build our own works, we charge the city for treating the refuse. We made two propositions to the city of Cincinnati. Unfortunately for the city, they could not legally accept our proposal to sell them a plant, but our second proposal was accepted.

We built our own plant and the city pay us a sum equivalent to forty-two cents a ton, but if the city could have accepted the first proposition, it would have cost them only about six cents a ton, which cost includes the interest on the amount paid for the plant.

CHAIRMAN. Is there anything else to be said upon the sanitary side of the question? If not, I have the honor to present to the Association his Honor, the Mayor of Lynn.

REMARKS OF MAYOR HAYES.

Gentlemen, I regret extremely that an important duty made it necessary for me to be away at the first of the meeting, that I was unable to hear the scientific papers that were read, and bid you welcome at the outset; but it gives me pleasure now to welcome you to Lynn, to see our city, and to pass judgement, the judgement of experienced men, upon our health conditions.

The subject that you have had before you to-day is coming to be more and more important to municipalities like this, and the tendency of population to concentrate is going to make it more prominent than it is even to-day. To a man in my position when such a matter as the cholera scare comes up, this is a question in which dollars and cents do not count very much. When you are confronted with the lives and health of your community, bills and checks do not show much on the other side. This matter of the safe disposal of house offal was thrust upon me when this cholera scare was before our community, and I gave a few day's investigation to it. I was surprised, and I think every one who has investigated the subject must be surprised, that a question of such scientific significance, a question bearing so much upon the homes and the lives of a community, has not yet been more carefelly wrought out. I found as Mr. Hurlburt has said, that there was a certain indefiniteness about all of the systems and propositions, and that where cities are located like this upon the seaboard there was a system already at hand for the safe disposal of such matters. I found safety to be simply a question of detail, simply a question of carrying far enough out to sea, simply a question of towage. I am not a scientific man, and I have made no scientific investigations into this matter, but any man must know, with the amount of water that there is in the ocean, which our

geographies used to tell us about, if their statement is to be relied upon, that the dumping of what garbage can be collected in a city like this from now until eternity will never cause any damage or danger. It is simply a question of towing it to sea far enough, and of care in dumping. If it can be disposed of cheaper by cremation or by other processes, that, of course, is a business advantage. But the prime thing for men in public position and charged with responsibility to consider is the health of the community, and where we are confronted with the difficulties and dangers that we are, and which are bound to increase as population increases, it does not matter what the cost, it does not matter how much trouble there is about it. It is one of the things we must have.

But, gentlemen, I did not mean to get into any discussion of this question; it is rather hard work for me to keep out of a discussion, when there is one going on. I simply wanted to welcome you to Lynn, and call your attention to the other health conditions we have. Your chairman has asked me to call your attention to our park, and it gives me great pleasure to do it. We have the largest park, gentlemen, the largest breathing place for our community, of any city in the United States,—relatively. We have a park of 2,000 acres. We have a beautiful sea-shore, as you have observed, probably. We have as healthy conditions as any community, and we want to improve it further by getting rid of the refuse matter that is collected from our streets and houses with safety to the public health and as cheaply as may be. I hope sincerely that light will be thrown upon this subject to-day that will enable us in some way to successfully accomplish that. It gives me pleasure to welcome you here to-day. I hope your stay will be pleasant and enjoyable, and that you will carry away from Lynn good impressions of our city.

Adjourned.

HEATING AND VENTILATING.

SCHOOL-ROOM VENTILATION.

The following is the substance of a special article which attracted much attention when printed in the annual report of the Maine State Board of Health for 1891: —

"Good ventilation, lighting, and warming of a school-room," says Sir Edwin Chadwick, "will augment the capacity of attention of the pupils by at least one-fifth, as compared with that of the children taught in school-rooms of the common construction."

The principal of a school formerly without ventilation, but now with fairly good provisions for renewing the air, makes the following statement of the beneficial results observed: "In point of health there has been a decided gain. Both pupils and teachers are doing more and better work on account of the purity of the air; there have been no complaints of headache and *ennui*, formerly so frequent; the children have been in no way exposed to draughts from open doors and lowered windows, consequently have been entirely free from coughs, colds and catarrhal affections."

Yet so important as good ventilation is, most of the so-called arrangements for ventilation found in school buildings are barefaced shams. They have been put in with no intelligent understanding of the rudiments of the principles involved in the question. For instance, the foul air ducts have almost invariably been found much too small, or they are leaky, or they are long and tortuous, or they are not constructed with a flue to carry the foul air outside the building, or the flue is unheated, or there is some other serious blunder. Tested with the air meter, the air in the fresh air and the foul air ducts, shows, in many instances, absolutely no movement. If there is any movement, it is almost always too feeble to approximate a fair ventilation, taking the size of the duct into consideration.

I have been more than astonished to find the number of so-called "experts" in the heating of school buildings scattered through the country, unknown men, of course, but nevertheless so impressed by their own importance and so convinced that they have grasped and digested in one supreme mental effort, without any practical investigation or study, all that there is to know about the heating and ventilation of buildings, that it is

as useless to attempt to reason with them as it would be to expect the Egyptian Sphinx to answer questions. These stupid oracles of school boards and committees cause more trouble and inconvenience and do more to prevent the introduction of good systems than any other one thing that I know of. They so hamper and disgust men of sound sense and judgement who, rather than enter into any controversy, let them have their way to the detriment of the building and the discomfort of its occupants. I have found such cases as this repeatedly, and I believe all others in my profession are troubled in the same way.

It is a fact that modern science brings to our notice repeatedly that the functional activity of organic life engenders products that are detrimental to the organisms that produce them ; thus, the vital activity of the yeast plant is gradually brought to a standstill by the accumulation of the product of its functional activity, — alcohol — and its activity can be started again only by re-establishing the conditions favorable to its continued growth; to wit, the removal or dilution of the alcohol in its field of growth. With the bacteriologist it is an every day observation that bacteria, grown in his culture media, thrive luxuriantly for awhile, then, if not transferred to fresh culture media, pass through a stage of lessened activity, and finally perish, poisoned by their own excretions, or remain dormant. These organisms, reduced to the utmost simplicity of structure, consist of a single cell. Man and the higher animals are components of a vast accumulation of cells, each one of which, by virture of its functional activity is likewise excreting products that are so poisonous to it and the system generally that accumulation beyond certain limits results in death.

Better for the mind and body one hour of sharp close study in a pure atmosphere, than two hours spent in languid, listless work in the polluted air of the unventilated school-room. Better, if this must be the price of securing pure air, to economize by shortening daily sessions, or in almost any way so be it the physical basis of mental action is not undermined while mental activity is still spurred on.

" We would consider parents crazy," says Dr. Bell, " who gave their children a moderate dose of opium, tobacco, or some other stupefying drug before setting them at their studies ; but these narcotics would be no less weakening and paralyzing in their effects, nor any less poisonous in their permanent effects, than

the air of the most of the school-rooms to which we send our children year after year."

It was formerly taught that the unpleasant effects from re-breathed air are due to the gas, carbonic acid. The following facts served as the basis of this belief. One of the most marked changes undergone by air in serving the process of respiration is a great increase in its quantity of this gas. While the free air of the outer world has from three to four parts of carbonic acid in 10,000, the air of expiration contains more than 100 times as much of this gas. Carbonic acid is unsuited for supporting the process of respiration. A lighted taper plunged into it is suddenly extinguished. Animal life is almost as suddenly extinguished when enveloped in it. Mixtures of this gas with common air in varying proportions, cause death more slowly, or may give rise to various symptoms indicative of insufficient oxidation of the blood and of the animal tissues. Later observations, however, have shown that, with a given percentage of carbonic acid in the air breathed by man or animals it makes a great difference whether the excess of carbonic acid has been derived from pure chemical sources, or from the lungs of living beings. For instance, the air of a school-room that contains twenty parts of carbonic acid in 10,000 of air, is found to be disagreeable and harmful to breathe ; while the air of an experimental chamber charged by chemical processes with twenty parts of carbonic acid, or with even more, is breathed with no disagreeable results. Observations of this kind easily lead to the assumption that the air expelled from the lungs contains some substance other than carbonic acid deleterious to animal life.

Entering a crowded and ill-ventilated school-room we have an unpleasant consciousness of a malodorous something which is characteristic of a stagnant, re-breathed air. Such air has an excess of carbonic acid, but carbonic acid is odorless. This disagreeble something excreted from the lungs has the power of clinging to a room rather tenaciously, for, if the ventilation of a school-room is neglected for a while, it takes some time to rid the room of the foul odor, even with ventilation through wide open windows. Chemical tests show that this ill smelling something is an organic nitrogenous substance.

When carbonic acid gas, either pure or mixed in rather large proportion with air, is breathed, asphixia and death may result.

When breathed habitually in such proportions as are found in badly ventillated school-rooms, there is reason to believe that the free exchange of oxygen and carbonic acid in the lungs is in some degree interfered with. Nevertheless this gas is not regarded poisonous in the sense in which we know some of the other components of polluted air to be. In the quantity in which it is found in school-rooms our chief interest in it is that we can use it as an index of the total pollution of the atmosphere. As chemistry presents no convenient and trustworthy method of estimating directly the degree of organic pollution, we solve the problem indirectly by a determination of the proportion of carbonic acid. Experience and observation have made it very certain that the organic nitrogenous pollution corresponds very closely with the carbonic acid content of an atmosphere fouled by respiration.

When the draft in school-room heaters is insufficient, and consequently when combustion is incomplete, full oxidation of the carbon of the fuel does not take place and carbonic oxide is formed. The escape of this gas into the school-room is a much more serious matter than an admixture of carbonic acid. The poisonous qualities of carbonic oxide are intense and positive. It seizes strongly upon the hæmaglobin, and, as its affinity for this coloring matter of the blood is greater than that of oxygen, it is destructive of the oxygen-carrying function of the red corpuscles of the blood. Persons who are profoundlv narcotized with carbonic acid may speedily be restored to life and health by prompt removal to the fresh air, or when breathing is extinct, by artifical respiration. Not so with carbonic oxide. Poisoning with this gas is a much more serious matter. Owing to the close chemical union of it with the red blood corpuscles, the admission of fresh air into the lungs, or even of pure oxygen gas, is almost powerless to make the poisonous gas lose its hold, and death will follow in many cases in spite of the most skillful treatment

Much has been said of late years about the power of diffusion of carbonic oxide through the castings of stoves and furnaces when they are too highly heated. To avoid the danger of this is only one of several weighty reasons for putting in school-room heaters whose radiating surface is so ample as never to become very hot. Dampers and other draught-checks between the fire and the smoke flues endanger the leakage of this gas.

Carbonic oxide is doubly dangerous for being, like carbonic acid, entirely devoid of smell.

Hydrogen Sulphide is very poisonons, and even when mixed in small quantities with air is dangerous to breathe. Breathed into the lungs, it robs the blood corpuscles of their oxygen and destroys them. As is the case with carbonic oxide, when hydrogen sulphide is habitually breathed in small quantity, chronic poisoning results, it impoverishes the blood and leads to pallor and feebleness. This gas is given off from many organic substances when undergoing decomposition, and from these sources it sometimes gains admittance to school-rooms

The sanitary arrangements of the school-house should be such as to preclude the possibility of the entrance into the school-room of the gases of putrefaction, derived from privies, sewers and urinals. A large component of these gases is hydrogen sulphide, mingled with ill-smelling ammoniacal prodncts and other gases. The great mass of medical and sanitary experience indicates that the prolonged breathing of air tainted with but a small admixture of these gases has a debilitating effect and predisposes strongly to other diseases: Anæmia, scrofula, consumption, diarrhœa, dysentery, diphtheria, typhoid fever, etc. Children especially are more susceptible than older persons to the noxious influences of privy and sewer emanations. Breathed in concentrated doses, even adults are often overcome with pain in the stomach and the joints, headache, nausea, and vomiting, muscular weakness, asphyxia and sometimes death.

Humidity of the Air.—We have been taught by most writers on the subject that the air of artificially heated rooms should have a considerable degree of humidity and that special provisions should exist in connection with the heating apparatus for the evaporation of water. It is very likely, however, that many of the unpleasant results ascribed to dryness of air are referable to conditions, the removal or mitigation of which is more rational than the evaporation of water. They are due undoubtedly in some cases to the leakage into the air of harmful gases from the stove or furnace. Generally the trouble is in connection with heaters that are altogether unsuitable for use in school buildings. Their heating surfaces are so small that they must be heated highly to keep the rooms at a comfortable temperature. Consequently the air coming into the rooms from the apparatus is overheated, its suspended organic matter has been

scorched and has thereby liberated traces of harmful gases, and the air has perhaps received an additional contamination by diffusion through the unduly heated radiating surfaces, or through their joints. In school houses supplied with heaters that furnish an ample quantity of fresh air only moderately warmed, there is rarely complaint of dryness of the atmosphere.

The evaporation of water for the special purpose of moistening the atmosphere, is an expensive process: it calls for the burning of an additional portion of fuel, the heat of which is expended, not in warming the rooms, but in converting water into steam. The expenditure of the money in warming larger volumes of fresh air, and thus, in securing better ventilation, would be a more judicious investment.

In any system of school-house ventilation worthy of respect, the heating of the rooms and their ventilation are so intimately connected, that it would be difficult to consider them separately, and it is not desirable to do so. To ventilate a school-room properly, the incoming air must be warmed artificially before it is discharged into a room; and to warm a school-room in all its parts with an approximation to uniformity of temperature, the current of incoming warm air is needed to prevent stagnation and stratification of the school-room air.

Heating is said to be by *direct radiation* when the heater is placed in the room to be heated.

A room is heated by *indirect radiation* when its heater is not placed directly in it, but is enclosed within a space through which fresh air is warmed, as it passes on its way to the room.

Natural ventilation is that kind of change of air secured when doors and windows are allowed to remain open. An efficient ventilation of this kind is of course entirely impracticable the greater part of the year.

Artificial, or forced ventilation is obtained by the employment of some artificial means for moving the air. The forces the most frequently used for this purpose are the rarefying power of heat applied to air in flues and mechanical power applied through the medium of fans.

When the force is applied in forcing air into a room we speak of the *plenum* method.

When exerted in removing air from a room the term *extraction*, or *vacuum method* is used to designate it.

There is a marked difference in the advice of American and European authorities as to the proper temperature for the

school-room. For instance, at a rather recent meeting of a teacher's association in England, it was stated that from 55° to 60° Fahrenheit is the proper temperature. Habituation to rooms too highly heated, and perhaps other conjoint causes, have rendered our school populations unable to bear comfortably or safely temperatures so low as these. It is desirable, however, to keep the school-room air at as low a temperature as is compatible with comfort. For our pupils the temperature should be kept between 65° and 68° Fahrenheit. Provided the pupil's clothing is dry and the school-room air is fresh and pure, degrees of temperature between these extremes will be comfortable and more conducive to health than higher degrees.

Uniformity of temperature in all parts of the room is greatly to be desired. It can be obtained in a well ventilated room; it cannot be had in a room in which a proper rotation of the mass of the air is not provided for by the ventilating arrangements. The difference in temperature near the floor and near the ceiling should be but a very few degrees.

When the incoming warmed air is only moderately heated a uniformity of temperature at different levels is much more easily maintained. There are also other important reasons why the heater should deliver the air at a very moderate temperture, a temperature that we are told by Rietschel should not exceed 30° C. (86° F.), and that in some of the best work in this country does not exceed this.

WARREN VENTILATING AND SANITARY CONSTRUCTION.

THE Fuller & Warren Company of Troy, N. Y., and Chicago, Ill., with Boston offices at No. 43 Milk street, pays particular attention to warming, ventilating and sanitary construction as applied to school houses and other public buildings. The necessity of properly ventilating schools and other buildings where many human being are brought into close contact for many hours at a time is recognized by parents and public authorities alike.

Sanitary warming cannot be successfully accomplished without ventilation, that is, the introduction of sufficient quantities of pure air at a comfortable temperature. The best recognized authorities are agreed that from 25 to 30 cubic feet of air per minute should be furnished for each person in a school room. In order to secure this ventilation and properly control it, a building must be tightly constructed. This is also necessary to effect an economical use of fuel. True economy demands the expense of heated aspirating shafts. The fuel expended there to produce force will be more than compensated for by the increased heat units which the inflowing currents will convey to the rooms in a given time. There should be an avoidance of haste in the consuming of fuel. The want of sufficient air for perfect combustion causes an immense waste of valuable unconsumed gases and the formation, where hard coal is used, of clinker or slag.

A warm air furnace properly applied is the most satisfactory solution of these problems. The fresh air should be secured through, clean, tight, non-conducting flues and the air should then be heated in a properly constructed chamber. After distribution, the air, having become foul, should be exhausted directly into the aspirating shaft, but when the expense of fuel is taken into account, the circulation and reheating of the air in a room is a great saving and can do no harm for the 16 hours that a school room is ordinarily empty. For this reason, the vitiated air may be returned to the basement and from there during the day to the aspirating shaft and to the warming chamber throughout the night.

The Fuller & Warren furnaces and ventilating appliances are carefully constructed according to the latest and most approved methods of accomplishing the desired results as described above. Their construction is based upon the intent to secure Power, Economy, Durability and Easy and Efficient Control. That these objects are all accomplished is readily proved by the hundreds of testimonials the system has received from Superintendents of Schools and Superintendents of Public Buildings all over the country.

The sanitary closet system of the same company also presents the same careful attention to healthful necessities and has received the same unanimous and unvarying endorsements whereever used.

THE VALUE OF DISINFECTANTS.

PHYSICIANS are not prone to underestimate the danger of contagion from the absence of proper purification of the air in our houses, but it is a matter to which the ordinary citizen pays too little attention.

In the rush and hurry of our active American life the ordinary man, unless the odor be particularly prominent, never stops to think that his own life, and that which he holds dearer, the lives of his wife and children, are daily threatened by the presence of the noxious vapors that so often arise from sinks or closets. The presence of these vapors may be due to improper, imperfect drainage, or to some foreign matter, that, lodged in the pipe, does not entirely obstruct the flow of water, but is constantly decomposing, and, so long as it remains, is a constant menace to good health.

The same need of sanitary precautions is equally prominent in stables, while sick chambers and hospitals are fruitful breeding grounds for contagion of every kind. Storage rooms and ice chests should be kept equally pure for the proper preservation of food which, once contaminated, is a menace to the health of every partaker.

To overcome these dangers, and secure to our homes or other surroundings a pure, healthful atmosphere, it is absolutely necessary to have a perfect disinfectant. Such a material is found in THAYER'S ODORLESS DISINFECTANT.

This preparation is unsurpassed. Its action is prompt and thorough, it is free from both odor and color, and is convenient and economical.

It immediately arrests the putrid decomposition of animal and vegetable matter, and readily destroys all fetid and poisonous gases dispelled from the same.

It is prepared in quart bottles, by Henry Thayer & Co., of Cambridgeport, Mass., and is sold at $4.00 per dozen.

The same firm also prepare and sell THYMOZONE, which is an invaluable antiseptic, prophylactic and detergent. It is a fragrant, non-irritating liquid, free from color, and is successfully used in both external and internal treatments.

It is of great value in dental surgery, cleansing the mouth, hardening and healing soft and ulcerated gums, and preserving the teeth from decay. Its antiseptic, deodorizing and cicatrizing virtues render it of great value in arresting unhealthy discharges from suppurating or gangrenous burns, wounds and ulcers, inflammation of mucous membranes, and in a variety of skin diseases.

As a prophylactic and detergent it will be found of great advantage in maintaining cleanliness and promoting recovery in cases of gonorrhœa, leucorrhœa, obstetrical surgery, etc. Inhaled as an atomized solution, it cures diphtheria, bronchitis, etc., and taken internally, it affords great relief to ulceration of the stomach or bowels, typhoid and scarlet fevers, cholera and other diseases associated with bacteria. A 16 oz. bottle costs but 75 cents.

PURE WATER.

EVERYONE is agreed that pure water we must have, at least for table and other domestic uses. If we would preserve our health as individuals and as a community, it will not do for us to trifle with the dangers to a perfect sanitary condition that are incident to a dependence upon a contaminated source of water supply. Scientific experiment has clearly shown that in one way only can perfectly pure water be obtained, and that is by evaporation and condensation; that is, by distillation. In some instances filtered water is worse than the unfiltered, because the filters, becoming saturated and overcharged with offensive substances, contaminate the water that passes through them.

At no time can water that comes in contact with the decaying vegetable and animal substances that compose the soil, particularly in thickly populated localities, be free from disease producing germs, often so small as to be invisible and to elude the ordinary methods of filtration. Where this condition exists the filter is powerless.

To obviate these and other dangers, the Hygeia Sparkling Distilled Water Company of New York offers to furnish in any part of the United States, ABSOLUTELY PURE WATER at a price within the reach of all.

Hygeia Distilled Water will stand every test known to scientists for determining purity. It contains no solid matter, either in solution or suspension. It is the only drinking water that will stand Nessler's test, the most delicate one known for the detection of organic matter in water. It is also the only drinking water which will stand the silver test for the detection of chlorine, the absence of which preludes sewage contamination.

The following is its analysis, conducted by Prof. Wood of the Harvard Medical College:

	Parts per 100,000.
Free Ammonia	0.0076
Albuminoid Ammonia	0.0003
Residue	None.
Chlorine	None.
Nitrates	None.
Color	None.

Hygeia Lithia Water is a product of Hygeia Distilled Water which has received the overwhelming endorsement of the medical profession It is not claimed that it is a specific for any disease. Its maker's sole object has been to place before the medical profession a purely alkaline water, which physicians can order for any of the various diseases associated with acid diatheses, and where an alkaline water is indicated. This has been accomplished. Hygeia Lithia contains 12 grains of pure Lithium Carbonate to each U. S. gallon of Hygeia Distilled Water, which is equivelant to 22.06 grains of Lithium Bicarbonate, or almost twice as much as all the other Lithia Water on the market combined.

C. S. Curtiss & Co., No. 60 Broad street, are the Boston agents.

THE BLUE HILL MINERAL SPRING.

IN the town of Blue Hill, in Hancock County, on the eastern coast of Maine, is Blue Hill Mountain. On this mountain, six hundred feet above the sea level, is the wonderful Blue Hill Mineral Spring. The vicinity is the most picturesque on the famous Maine coast. From the summit of Blue Hill Mountain can be seen the thirteen peaks of Mt. Desert Island; also Sorrento with its new hotel and handsome cottages, Frenchman's Bay, Sullivan, Deer Isle, Brooklin, Cape Rozier and Castine, together with the hills of Gouldsboro, Sedgwick and Camden.

This universal wealth of varied natural scenery charms at once the eye and senses, but the spring itself is the attraction that most demands the invalid's attention.

The first official notice the spring received was in 1838, when Dr. Charles T. Jackson, after a two years' geological survey of the state, alluded to it as a remarkable chalybeate spring, and unhesitatingly prophesied its future popularity as a medicinal water. His prophecy has been realized. A company, named the Blue Hill Mineral Spring Company, has been formed. The headquarters of the company are at Ellsworth, Me., and the Boston office is at 4 Liberty Square, corner of Water Street.

Improvements have been made about the spring, and arrangements made for marketing its waters. The water is entirely free from any organic impurities, and is particularly valuable in all kidney troubles, chronic inflammation of the bladder, etc. As it contains the salts of the blood, it becomes a tonic of great value, and is an aperient unsurpassed by any mineral water on the market.

The following is the report of an analysis recently made by Prof. S. P. Sharples, of Boston:

	PARTS IN 100,000.
Silica	1.85
Sodium Chloride (Salt)	.50
Sodium Sulphate	1.40
Sodium Carbonate	.26
Calcium Carbonate (Lime)	3.21
Ferrous Carbonate (Iron)	1.01
Total solids at 212 Fahrenheit	8.23
Organic Matter	Traces
Free Ammonia	Traces
Albuminoid	.0032

There is a fine summer hotel in the vicinity of the spring, and it seems destined to become an objective point for those whose ailments the medicinal qualities of the water are so well fitted to alleviate.

THE DAVIDSON VENTILATING FAN.

THE reason why the Davidson Ventilating Fan Co., Boston and New York, advocate the Exhaust System, in preference to the Plenum Method in ventilating is this: In the Plenum Method the heated air is brought into the room, usually at a height of 9 to 11 feet from the floors in schools and other large rooms; under considerable pressure, in some cases amounting to 3-4 oz. to the square inch.

Other openings are made in the room, usually at or near the floor line. The supposition in this arrangement is that the pressure from the inlet will force the air into the rooms and out again through these openings. This is all very well in theory, but when it comes to putting theory into practice, what happens? Take for instance an ordinary school or large room where considerable ventilation is required, say from 1,500 to 2,000 cubic feet per hour. The warm air inlet is at a height of 9 feet from the floor, and of such a size that to bring in the required amount of air, a velocity is attained of from 700 to 800 feet per minute. (This velocity is not at all unusual where this method is used.) We have another opening at the base line of nearly the same size as the inlet, leading to the ventilating shaft. At the outlet, instead of attaining the looked for velocity of 700 feet, we find that we have an actual velocity of only 300 or 400 feet per minute.

It would appear from experiments that that part of the room occupied, that is to say, that part six feet above the floor, is not ventilated to any great extent, and we find this to be invariably the case where the plenum method alone is used. By the use of the Davidson exhaust method, the air is being constantly brought to the bottom of the room, (that is, if the outlet is so located) by the vacuum produced there by means of the radial fans manufactured by this Company. As we exhaust the air from the room, fresh air comes in through the warm air duct to take its place. These fans may be placed either in the basement or in the upper part of the building, according to the construction of the same.

In the system used by this company the air is brought into the school or audience room at a velocity not greater than from 400 to 450 feet per minute; unless the room is very large, with ceilings at least 25 feet in height, thus obviating unpleasant drafts or air currents, which are sure to manifest themselves if a greater velocity of air is permitted.

For heating they use either steam, hot water or hot air furnaces, as may be best adapted to the purpose, and they are at all times ready to correspond with those who want efficient ventilation, either with or without heat, as desired.

NOBSCOT MOUNTAIN SPRING WATER.

THE water of Nobscot Mountain Spring is a natural product that within the past few months has created a decided sensation in Boston and vicinity.

Its extreme purity is so conclusively proved by the most careful and scientific analysis that it has appealed directly to popular favor, and is daily receiving the commendation of physicians and others who appreciate the danger to individual and public health, arising from the use of impure water.

The following analysis was made by Drs. Davenport and Williams, the former for many years State Assayer, and is fully endorsed by the printed report of the Massachusetts State Board of Health:

	Parts per 100,000.	Grains per U. S. Gal.
Total Solids	5.5	3.2105
Organic and volatile matter	1.1	0.6421
Fixed Solids	4.4	2.5684
The fixed solids consist of:		
Silica	0.900	0.5254
Sesquioxides of Iron Alumina	0.042	0.0245
Lime	0.721	0.4209
Magnesia	0.186	0.1086
Chlorine	0.375	0.2189
Sulphuric Acid	0.230	0.1343
Soda	0.709	0.4139
Potash	0.278	0.1623
These constituents are probably combined as follows:		
Sulphate of Potash	0.508	0.2965
Sodium Chloride	0.618	0.3607
Sodium Carbonate	0.653	0.3812
Carbonate of Lime	1.288	0.7518
Carbonate of Magnesia	0.391	0.2282
Sesquioxides of Iron and Alumina	0.042	0.0245
Silica	0.900	0.5254

The water is limpid, clear and white, and slightly alkaline. These results show this water to be one of unusual purity for a natural water. Its use as a drinking water can therefore in every way be recommended.

The same chemists also pronounce the Nobscot to contain all the elements mentioned in the published analysis of the famous Poland Spring water, while they say the latter contains fifty per cent. more earthly impurities than the Nobscot.

The spring is located on Nobscot Mountain, in Framingham, the highest point of land in Middlesex County, and is so remote from dwellings or other sources of foul drainage that contamination from them is an absolute impossibility. The Boston office is at 62 Congress Street.

THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH was organized in Boston, Mass., on March 19, 1890, with the following objects: The advancement of sanitary science in the State of Massachusetts; the promotion of better organization and co-operation in the local Boards of Health, the uniform enforcement of sanitary laws and regulations, and the establishment of pleasant social relations among the members of the Association. All persons holding appointments as members of a Board of Health in a Massachusetts city or town, the executive officers of such a local board, and the members of the State Board of Health, and such other persons as may be elected, are eligible to membership. The annual dues are three dollars. This Association has four regular meetings each year, the annual or January meeting always being held at Boston.

THE JOURNAL OF THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH is a quarterly publication containing the papers read at the meetings, together with verbatim reports of the discussion. It will also contain from time to time interesting contributions from writers of the highest standing in their profession. It affords a convenient medium for the interchange of information and experience between its members, who are so widely separated as to find frequent meetings an impossibility. Every addition to its subscription list, therefore, is a material aid in extending its sphere of usefulness. All members of the Association receive the JOURNAL in return for their annual dues; to all others the subscription is one dollar per annum in advance. If upon inspection of the accompanying copy you feel so inclined, we should be glad to receive your subscription. The JOURNAL will also be sent to the principal Hospitals, School Boards, Doctors, Architects and Boards of Health.

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